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For related information see also *Astronautics*.

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Includes quantum mechanics; and Bose and Fermi statistics.
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## SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.


**80 SOCIAL SCIENCES (GENERAL)** 2216
Includes educational matters.

**81 ADMINISTRATION AND MANAGEMENT** 2216
Includes management planning and research.

**82 DOCUMENTATION AND INFORMATION SCIENCE** 2217
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

**83 ECONOMICS AND COST ANALYSIS** N.A.
Includes cost effectiveness studies.

**84 LAW AND POLITICAL SCIENCE** N.A.
Includes space law; international law; international cooperation; and patent policy.

**85 URBAN TECHNOLOGY AND TRANSPORTATION** 2217
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*


## SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*


**88 SPACE SCIENCES (GENERAL)** 2218

**89 ASTRONOMY** 2222
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

**90 ASTROPHYSICS** 2223
Includes cosmology; and interstellar and interplanetary gases and dust.

**91 LUNAR AND PLANETARY EXPLORATION** 2226
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

**92 SOLAR PHYSICS** 2227
Includes solar activity, solar flares, solar radiation and sunspots.

**93 SPACE RADIATION** 2228
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*


## GENERAL


**99 GENERAL** N.A.


**Note: N.A. means that no abstracts were assigned to this category for this issue.**


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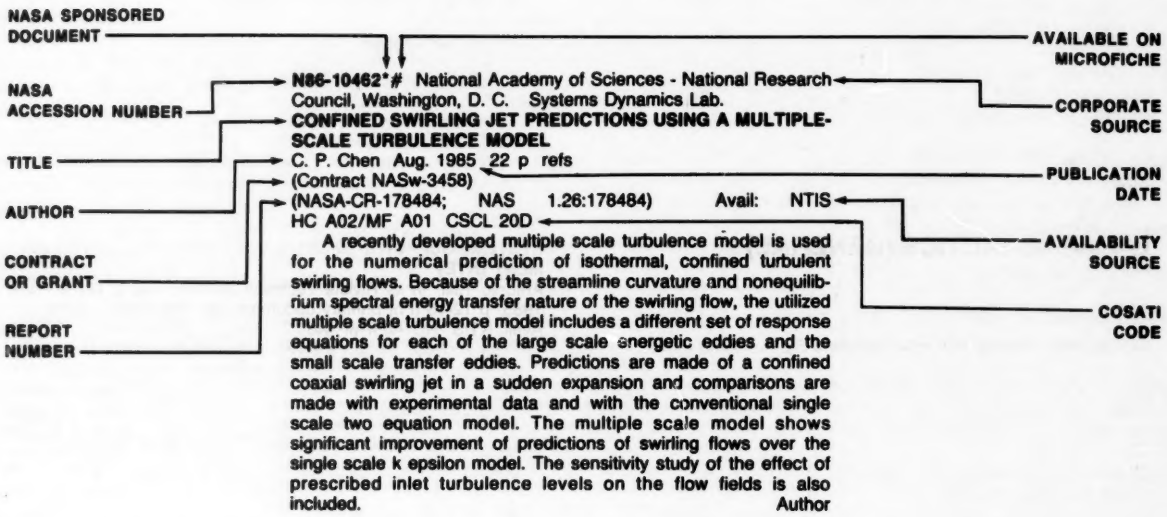
# TYPICAL CITATION AND ABSTRACT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N86-10462*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NASw-3458)
REPORT NUMBER
(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
AVAILABILITY SOURCE
HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

VOLUME 24 NUMBER 13 / JULY 8, 1986

# Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

## 01 AERONAUTICS (GENERAL)

**N86-22537#** Selenia Industrie Associate S.p.A., Rome (Italy).
**RIVISTA TECHNICA SELENIA, VOLUME 9, NUMBER 3, 1985**
1985 36 p refs
Avail: NTIS HC A03/MF A01

Electronic and communication automatic test systems are discussed, referring to the Tornado combat aircraft test systems. The subjects include system architecture, the role of advanced computer languages, software quality control, system design analysis and evolution trends. For individual titles, see N86-22538 through N86-22543.

**N86-22538#** Selenia Industrie Associate S.p.A., Rome (Italy).
**THE MRCA AUTOMATIC TEST SYSTEM**
Paolo Cecchini *In its* Rivista Technica Selenia, Vol. 9, No. 3, 1985 1985 p 1-6 ref (For primary document see N86-22537 13-01)
Avail: NTIS HC A03/MF A01

The automatic test system used to test the Tornado aircraft is described. Each piece of test equipment is dedicated to a single technological class, defined on the basis of the frequency range at which it operates, from low frequency to microwave. Avionics is conceived as a set of line replaceable units tested at self standing test stations including a controller, switching devices, input-output interfaces, and appropriate instrumental configuration (dedicated or common) which carry out the test under the test control program. The interface with the operator is a video display unit. As an example of system performance, the flight computer control time is reduced to one tenth of the normal time required. Author (ESA)

**N86-22539#** Selenia Industrie Associate S.p.A., Rome (Italy). Aircraft Support Equipment Group.
**COMPLEX SYSTEMS INTEGRATED LOGISTIC SUPPORT: AUTOMATIC TEST EQUIPMENT (ATE) AND TEST ORIENTED LANGUAGES ROLE**
Silvino dErcole *In its* Rivista Technica Selenia, Vol. 9, No. 3, 1985 1985 p 7-11 refs (For primary document see N86-22537 13-01)
Avail: NTIS HC A03/MF A01

The choice of language to be used in software design of automatic test equipment is discussed. The Abbreviated Test Language for Avionics Systems (ATLAS) is described and its performances are compared with those of Basic. A very important aspect introduced by ATLAS is that a change of the intrumentation used has no impact on an ATLAS test program. An example of the same program written in ATLAS and in Basic is given. It is also shown that the ATLAS program is considerably shorter.
Author (ESA)

**N86-22540#** Selenia Industrie Associate S.p.A., Rome (Italy). Aircraft Support Equipment Group.
**SELENIA'S CONTRIBUTION TO THE DEVELOPMENT OF SYSTEMS SUPPORT: MICROWAVE AUTOMATIC TEST EQUIPMENT (ATE)**
Antonio Tulli *In its* Rivista Technica Selenia, Vol. 9, No. 3, 1985 1985 p 12-16 (For primary document see N86-22537 13-01)
Avail: NTIS HC A03/MF A01

The facilities to support onboard radar systems, (active and passive) are described. A fundamental characteristic of the system is that the test simulates the whole of the operational conditions of the equipment itself. The system is implemented by functional elements including the test equipment, hydraulic system, dedicated boards and units, and line replacable unit adapters. The software is divided into base and applications, and is writen in ATLAS language.
Author (ESA)

**N86-22541#** Selenia Industrie Associate S.p.A., Rome (Italy). Defence System Div.
**QUALITY OF THE TORNADO ATS SOFTWARE** c61
Fabio Frontalini *In its* Rivista Technica Selenia, Vol. 9, No. 3, 1985 1985 p 17-21 (For primary document see N86-22537 13-01)
Avail: NTIS HC A03/MF A01

Software development management is discussed. The Tornado automatic test system, designed to work with a Siemens 330 computer, is implemented with a software written in ATLAS language. Its development is analyzed into several functional areas including precompiler (language ARINC 416-10), code generator, interpretative master program, supervisor, utility programs, and drivers for the test equipment dedicated instrumentation. The software quality assurance procedures are described. It is shown that the long term efficiency is enhanced, assuring an overall tried and tested procedure to support improvements of the project and overcoming the difficulties introduced by a multiplicity of companies participating in the project.
Author (ESA)

**N86-22542#** Selenia Industrie Associate S.p.A., Rome (Italy). Aircraft Support Equipment Group.
**IMPLICIT ACTIVITIES IN THE POST DEVELOPMENT PHASE**
Antonio Tulli and Silvino dErcole *In its* Rivista Technica Selenia, Vol. 9, No. 3, 1985 1985 p 22-27 (For primary document see N86-22537 13-01)
Avail: NTIS HC A03/MF A01

Development aspects of automatic test equipment to be supplied to a customer are discussed. A problem arises when a test system evolves after delivery. A study for third level support of automatic test equipment developed for second order level maintenance of the Tornado combat aircraft is included. Configuration control in three distinct intervention areas (documentation, hardware, and control) is also discussed.
Author (ESA)

**N86-22543#** Selenia Industrie Associate S.p.A., Rome (Italy). Aircraft Support Equipment Group.
**LINES OF EVOLUTION**
Antonio Tulli *In its* Rivista Technica Selenia, Vol. 9, No. 3, 1985 1985 p 28-31 (For primary document see N86-22537 13-01)
Avail: NTIS HC A03/MF A01

Advice on electronic test equipment choice criteria is given. The configuration and modularity of hardware and software are

examined. Global life cycle cost is negotiable against efficiency parameters at an early stage of system design. Author (ESA)

**N86-22544#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: TRANSPORTATION**
24 Jan. 1986 68 p Transl. into ENGLISH from various Russian articles
(JPRS-UTR-86-001) Avail: NTIS HC A04

Progress in transportation systems in the USSR is reported. Topics discussed include: civil aviation, motor vehicles and highways, rail systems, maritime and river fleets, ports and transshipments centers, and intersector network development. For individual titles, see N86-22545 through N86-22545.

**N86-22545#** Joint Publications Research Service, Arlington, Va.
**SCIENTISTS ON AIRCRAFT DEVELOPMENT TRENDS**
M. Golubeva and V. Zasimov *In its* USSR Report: Transportation (JPRS-UTR-86-001) 24 Jan. 1986 p 1-5 Transl. into ENGLISH from Grazhdanskaya Aviatsiya (Moscow, USSR), no. 9, Sep. 1985 p 22-23 (For primary document see N86-22544 13-01)
Avail: NTIS HC A04

Fuel consumption and the production of aircrafts and aviation fuels is discussed. Problems in producing synthetic fuels from shale oil, bituminous coal, and hydrogen are outlined. Fuel conservation which should be configurated in aircraft design, materials, and construction is discussed. Polymer composites for use in aircraft construction, such as high modulus fibers of graphite and boron are recommended. It is concluded that the introduction of the new technologies will improve aircraft performance and fuel efficiency. E.A.K.

**N86-22775#** Joint Publications Research Service, Arlington, Va.
**FUZZY INFERENCE SYSTEM TO DIAGNOSE AIRCRAFT HYDRAULIC FAULTS**
Shoupai Feng, Weigang Weng, and Liang Dong *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 134-141 refs Transl. into ENGLISH from Shuxue de Shijian yu Renshi (Beijing, China), no. 3, Jul. 1985 p 14-18 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

# 02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

**N86-22546** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**ANALYSIS OF DYNAMIC STABILITY DERIVATIVES FOR HIGH ANGLE OF ATTACK AIRCRAFT Ph.D. Thesis**
Joon Soo Ko 1985 184 p
Avail: Univ. Microfilms Order No. DA8521331

Modern, high performance aircraft are required to be able to fly and be controlled over a wide variety of flight conditions. In order to predict the aircraft behavior and control requirements over the entire flight regime it is necessary to have a proper aerodynamic model. In this research, wind tunnel experiments are performed on an F-5 aircraft model at high angles of attack, with small oscillations about the body oriented roll axis. In addition the free stream environment can be configured in one of three ways: (1) straight uniform flow, (2) curved flow to simulated a horizontal turn, and (3) rolling flow to simulated a roll motion about the relative velocity vector. A description of the wind tunnel velocity and the recently developed roll oscillatory rig is given. In addition new linearized equations of motion are developed for describing the small roll oscillation in the non-uniform flow environment. These equations are used to reduce the data obtained in the wind tunnel experiments in order to obtain the usual combined rotary and unsteady aerodynamic stability derivatives as well as new combinations of pure rotary derivatives obtainable only with the non-uniform flow conditions. Dissert. Abstr.

**N86-22547** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**APPLICATION OF PANEL METHODS FOR SUBSONIC AERODYNAMICS Ph.D. Thesis**
Meung Jung Kim 1985 186 p
Avail: Univ. Microfilms Order No. DA8516158

Several panel methods are developed to model subsonic aerodynamics. The vorticity panel method for two-dimensional problems is capable of handling general unsteady, potential, lifting flows. The lifting surface is modelled with a vortex sheet and the wakes by discrete vortices. As an imitation of the conditions at the trailing edge, stagnation conditions on both surfaces are used. The over-determined system is solved by an optimization scheme. The present predictions are in good agreement with experimental data and other computations. Moreover the present approach provides an attractive alternative to those developed earlier. Two panel methods for three-dimensional nonlifting problems are developed. One uses source distributions over curved elements and the other vorticity distributions over flat elements. For the source formulation, the effect of weakly nonlinear geometry on the numerical results is shown to accelerate the convergence of numerical values in general. In addition, the extensive comparisons between two formulations reveal that the vorticity panel method is even more stable and accurate than the curved source panel method. Dissert. Abstr.

**N86-22548** California Univ., Los Angeles.
**UNSTEADY AERODYNAMICS IN TIME AND FREQUENCY DOMAINS FOR FINITE-TIME ARBITRARY MOTION OF HELICOPTER ROTOR BLADES IN HOVER AND FORWARD FLIGHT Ph.D. Thesis**
Mehran Asghar-Hessari-Dinyavari 1985 549 p
Avail: Univ. Microfilms Order No. DA8525824

Several incompressible finite-time arbitrary-motion airfoil theories suitable for coupled flag-lag-torsional aeroelastic analysis of helicopter rotors in hover and forward flight are derived. These theories include generalized Greenberg's theory, generalized Loewy's theory, and a staggered cascade theory. The generalized Greenberg's and staggered cascade theories were derived directly in Laplace domain considering the finite length of the wake and using operational methods. The load expressions are presented in the Laplace, frequency, and time domains. Approximate time domain loads for the various generalized theories are obtained by developing finite state models using Pade approximant of the appropriate lift deficiency functions. Three different methods for constructing Pade approximants of the lift deficiency functions were considered and the more flexible one was used. In the second part of this study the influence of finite-state arbitrary-motion time-domain aerodynamics on rotor blade aeroelastic stability was illustrated for hover and forward flight conditions. Dissert. Abstr.

**N86-22549** Cornell Univ., Ithaca, N.Y.
**MULTIGRID CALCULATION OF SUPERSONIC POTENTIAL FLOW PAST INCLINED ELLIPTIC CONES Ph.D. Thesis**
Minwoo Park 1985 174 p
Avail: Univ. Microfilms Order No. DA8525784

A numerical method has been developed to study supersonic, potential flow past elliptic cones. Under the conical assumption, which implies that the flow properties do not vary with distance along straight rays from the vertex of the flow, the governing equation of motion reduces to a two-dimensional one on a cross-plane of the flow. A finite difference equation has been developed on this surface using the finite volume method in a fully conservative form. Both first- and second-order artificial viscosities are used to capture the shock waves in the cross-plane. An ADI method, in conjunction with the multigrid algorithm, is used to provide an efficient and fast iterative scheme. Computations have been performed for various flow situations and body geometries, including the flow past thin wings at angles of attack. Differences between the conservative and non-conservative formulations of the difference equation have been studied. Good

results have been obtained using both the first- and second-order artificial viscosity terms. The results are compared with other available data. Dissert. Abstr.

**N86-22550*#** Boeing Commercial Airplane Co., Seattle, Wash.
**FLOW PREDICTION FOR PROPFAN ENGINE INSTALLATION EFFECTS ON TRANSPORT AIRCRAFT AT TRANSONIC SPEEDS Final Report**
S. S. Samant and N. J. Yu Washington NASA Jan. 1986 93 p refs
(Contract NAS1-17250)
(NASA-CR-3954; NAS 1.26:3954) Avail: NTIS HC A05/MF A01 CSCL 01A

An Euler-based method for aerodynamic analysis of turboprop transport aircraft at transonic speeds has been developed. In this method, inviscid Euler equations are solved over surface-fitted grids constructed about aircraft configurations. Propeller effects are simulated by specifying sources of momentum and energy on an actuator disc located in place of the propeller. A stripwise boundary layer procedure is included to account for the viscous effects. A preliminary version of an approach to embed the exhaust plume within the global Euler solution has also been developed for more accurate treatment of the exhaust flow. The resulting system of programs is capable of handling wing-body-nacelle-propeller configurations. The propeller disks may be tractors or pushers and may represent single or counterrotation propellers. Results from analyses of three test cases of interest (a wing alone, a wing-body-nacelle model, and a wing-nacelle-endplate model) are presented. A user's manual for executing the system of computer programs with formats of various input files, sample job decks, and sample input files is provided in appendices. Author

**N86-22551#** National Aerospace Lab., Tokyo (Japan).
**NUMERICAL ANALYSIS OF INVISCID FLOWS ABOUT WING-FUSELAGE COMBINATIONS. PART 1: DEVELOPMENT OF GRID GENERATION CODE YOKUDO-G**
Tomiko Ishiguro, Nobuhiko Kamiya, and Keiko Oguchi Jul. 1985 61 p refs In JAPANESE:ENGLISH summary
(NAL-TR-864; ISSN-0389-4010) Avail: NTIS HC A04/MF A01

The main purpose of this paper is to numerically analyze inviscid flows about wing-fuselage combinations. In the first series a numerical procedure is presented for grind generation about a wing-fuselage combination by the analytic mapping method. A user's manual for the FORTRAN code of the procedure is also described. Furthermore, many numerical examples are presented in order to show the utility of this code for several wing-fuselage combinations and in order to understand the role of the controllable variables which yield many patterns of mesh distributions. In the next series, numerical analysis of inviscid flows will be carried out under the grids generated by this numerical procedure. Author

**N86-22552*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**LOW-SPEED WIND-TUNNEL TESTS OF SINGLE- AND COUNTER-ROTATION PROPELLERS**
Dana Morris Dunham, Garl L. Gentry, Jr., and Paul L. Coe, Jr. Apr. 1986 46 p refs
(NASA-TM-87656; L-16077; NAS 1.15:87656) Avail: NTIS HC A03/MF A01 CSCL 01A

A low-speed (Mach 0 to 0.3) wind-tunnel investigation was conducted to determine the basic performance, force and moment characteristics, and flow-field velocities of single- and counter-rotation propellers. Compared with the eight-blade single-rotation propeller, a four- by four- (4 x 4) blade counter-rotation propeller with the same blade design produced substantially higher thrust coefficients for the same blade angles and advance ratios. The results further indicated that ingestion of the wake from a supporting pylon for a pusher configuration produced no significant change in the propeller thrust performance for either the single- or counter-rotation propellers. A two-component laser velocimeter (LV) system was used to make detailed measurements of the propeller flow fields. Results show increasing slipstream velocities with increasing blade angle and decreasing advance ratio. Flow-field measurements for the counter-rotation propeller show that the rear propeller turned the flow in the opposite direction from the front propeller and, therefore, could eliminate the swirl component of velocity, as would be expected. Author

**N86-22553*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**EFFECTS OF SOME GEOMETRIC VARIATIONS ON MISSILE AERODYNAMIC CHARACTERISTICS AT SUPERSONIC SPEEDS**
M. Leroy Spearman Feb. 1986 26 p refs Presented at the 24th AIAA Aerospace Sciences Meeting, Reno, Nev., 6-9 Jan. 1986 Previously announced in IAA as A86-19958
(NASA-TM-87683; NAS 1.15:87683) Avail: NTIS HC A03/MF A01 CSCL 01A

A summary of some results from tests of a wing-body general research missile model is presented for a Mach number range up to 4.63. A basic ogive-cylinder body with a length-to-diameter ratio of 10 was used to which was attached a series of wing planforms. The planforms included a family of delta wings and a family of rectangular wings having a constant root chord but varying spans so that wings of constant exposed area could be compared. In addition, a cranked-tip planform was included and a rectangular planform with reduced chord. Some results are presented for wing-body-tail configurations - one utilizing a cranked wing planform and one with wings having a constant root chord and span, but tip chords that were 0, 20, and 40 percent of the root chord. Author

**N86-22554*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SUPERSONIC AXIAL-FORCE CHARACTERISTICS OF A RECTANGULAR-BOX CAVITY WITH VARIOUS LENGTH-TO-DEPTH RATIOS IN A FLAT PLATE**
A. B. Blair, Jr. and Robert L. Stallings, Jr. Apr. 1986 21 p refs
(NASA-TM-87659; L-16075; NAS 1.15:87659) Avail: NTIS HC A02/MF A01 CSCL 01A

A wind-tunnel investigation has been conducted at Mach numbers of 1.50, 2.16, and 2.86 to obtain axial-force data on a metric rectangular-box cavity with various length-to-depth ratios. The model was tested at angles of attack from -4 deg to -2 deg. The results are summarized to show variations in cavity axial-force coefficient for deep- and shallow-cavity configurations with detached and attached cavity flow fields, respectively. The results of the investigation indicate that for a wide range of cavity lengths and depths, good correlations of the cavity axial-force coefficients (based on cavity rear-face area) are obtained when these coefficients are plotted as a function of cavity length-to-depth ratio. Abrupt increases in the cavity axial-force coefficients at an angle of attack of 0 deg. reflect the transition from an open (detached) cavity flow field to a closed (attached) cavity flow field. Cavity length-to-depth ratio is the dominant factor affecting the switching of the cavity flow field from one type to the other. The type of cavity flow field (open or closed) is not dependent on the test angles of attack except near the critical value of length-to-depth ratio. Author

**N86-22555#** Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
**RANDOM-CHOICE-METHOD SOLUTIONS FOR TWO-DIMENSIONAL PLANAR AND AXISYMMETRIC STEADY SUPERSONIC FLOWS**
Z. C. Shi and J. J. Gottlieb Jan. 1986 98 p refs
(UTIAS-297; ISSN-0082-5255) Avail: NTIS HC A05/MF A01

A random-choice method (RCM) is developed for obtaining fairly practical and efficient numerical solutions for two-dimensional planar and axisymmetric steady supersonic flows, such as those for sharp-edged planar airfoils, supersonic inlets of aircraft engines, pointed bodies of revolution, supersonic nozzles, and free jets. This method is based on the solution of a Riemann problem, which is the elemental solution of the hyperbolic equations of two-dimensional steady supersonic flows. The Riemann problem

consists of two waves separated by a slip stream, and each wave can be either an oblique shock wave or a Prandtly-Meyer expansion wave. Advanced techniques are given for solving the Riemann problem iteratively, handling the boundary conditions along body and free-jet surfaces, and computing only certain parts of flow fields of interest. Many interesting and practical numerical solutions are presented for different types of planar and axisymmetric flows, to demonstrate the applicability, capability, and limitations of the RCM. Numerical results are shown to be in excellent agreement with both known analytical solutions and results from the method of characteristics. Author

**N86-22556*#** Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
**VORTEX BOUNDARY-LAYER INTERACTIONS Semiannual Status Report, 1 Sep. 1985 - 31 Feb. 1986**
P. Bradshaw 1986 14 p
(Grant NAGw-581)
(NASA-CR-176701; NAS 1.26:176701) Avail: NTIS HC A02/MF A01 CSCL 01A

Parametric studies to identify a vortex generator were completed. Data acquisition in the first chosen configuration, in which a longitudinal vortex pair generated by an isolated delta wing starts to merge with a turbulent boundary layer on a flat plate fairly close to the leading edge is nearly completed. Work on a delta-wing/flat-plate combination, consisting of a flow visualization and hot wire measurements taken with a computer controlled traverse gear and data logging system were completed. Data taking and analysis have continued, and sample results for another cross stream plane are presented. Available data include all mean velocity components, second order mean products of turbulent fluctuations, and third order mean products. Implementation of a faster data logging system was accomplished. B.G.

**N86-22557#** Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
**SIMULATION OF INVISCID FLOW AROUND AIRFOILS AND CASCADES BASED ON THE EULER EQUATIONS**
Lars-Erik Eriksson 18 Jun. 1985 38 p refs
(Contract FMV-F-K-82260-83-146-25-001)
(FFA-TN-1985-20) Avail: NTIS HC A03/MF A01

The steady inviscid flow around an airfoil or through a cascade is computed by solving the Euler equations on an O-type grid. A centered finite volume method with an explicit time integration scheme is used to solve the equations on a given grid. In the case of incompressible flow artificial compressibility is used to obtain a correct steady solution with the same time-marching technique as for compressible flow. The O-type grid, which gives good resolution at the leading and trailing edges of the profiles, is generated by transfinite interpolation. Flow cases computed for airfoils and cascades are in good agreement with those of other numerical schemes for the Euler equations. Author (ESA)

# 03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

**N86-22558*#** Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
**WIND TUNNEL TESTS OF ROTOR BLADE SECTIONS WITH REPLICATIONS OF ICE FORMATIONS ACCRETED IN HOVER Final Report**
John D. Lee, Jack H. Berger (Fluidyne Engineering Corp., Columbus, Ohio), and Timothy J. McDonald (Fluidyne Engineering Corp., Columbus, Ohio) Mar. 1986 31 p refs
(Grant NAG3-374)
(NASA-CR-175089; NAS 1.26:175089) Avail: NTIS HC A03/MF A01 CSCL 01C

Full scale reproductions of ice accretions molded during the documentation of a hover test program were fabricated by means of epoxy castings and used for a wind tunnel test program. Surface static pressure distributions were recorded and used to evaluate lift and pitching moment increments while drag was determined by wake surveys. Through the range of the tests, corresponding to those conditions encountered in hover and in flat pitch, integration of the pressure distributions showed negligible changes in lift and in pitching moment, but the drag was significantly increased. Author

**N86-22559*#** Fluidyne Engineering Corp., Columbus, Ohio.
**DOCUMENTATION OF ICE SHAPES ACCRETED ON THE MAIN ROTOR OF A UH-1H HELICOPTER IN LEVEL FLIGHT Final Report**
M. K. Hanson and John D. Lee (Ohio State Univ., Columbus) Mar. 1986 14 p refs
(Grant NAG3-374)
(NASA-CR-175088; NAS 1.26:175088) Avail: NTIS HC A02/MF A01 CSCL 01C

Icing tests were conducted on a UH-1H helicopter in level flight behind a spray tanker near Duluth, Minnesota, during the winter of 1983-84 as part of the joint NASA/Army HIFT program. On landing, the ice formations on the main rotor were documented by casting a set of ten-inch molds on the blade using a Dow-Corning silicone rubber compound which was initially liquid at sub-freezing temperatures. Such documentation was accomplished for eight flights in which the temperature ranged from -11 C to -22 C and the in-cloud flight times ranged from 5 to 9 minutes. Author

**N86-22560#** Aeronautical Research Labs., Melbourne (Australia).
**THE AUSTRALIAN IMPLEMENTATION OF AMDAR/ACARS AND THE USE OF DERIVED EQUIVALENT GUST VELOCITY AS A TURBULENCE INDICATOR**
Douglas J. Sherman Oct. 1985 42 p refs
(AR-004-51; ARL-Struc-R-418) Avail: NTIS HC A03/MF A01

AMDAR is a system of measuring wind speed, wind direction, air temperature and an indication of turbulence from INS equipped transport aircraft in flight. These data are transmitted by radio to the meteorological system. This report outlines the Australian AMDAR system presently coming into service on the Boeing 767 aircraft in the Ansett fleet. The data are telemetered using ACARS and the SITA/AIRCOM network of ground stations. Particular attention is paid to the indicator of turbulence. Because an aircraft flying through a given gust may encounter very different vertical accelerations depending on aircraft mass, airspeed and altitude, it is proposed that the AMDAR system compute the derived equivalent gust velocity from the aircraft acceleration and other parameters, and that this is used as an indicator of turbulence. Such an indicator has the additional advantage that it is more use for climatological studies of turbulence occurrence than simpler indicators such as the aircraft vertical acceleration. Severe turbulence corresponds to derived equivalent gust velocities in excess of g m/s. Author

# 04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

**N86-22561#** Defence Research Information Centre, Orpington (England).
**HYBRID NAVIGATION BY DECCA AND DEAD RECKONING**
I. Okuda and E. Tanaka Jul. 1985 39 p refs Transl. into ENGLISH from Journal of Faculty of Marine Science and Technol-

ogy, Tokai Univ. (Japan), no. 19, 1984 p 59-76
(DRIC-T-7549; BR97252) Avail: NTIS HC A03/MF A01

Application of Decca to a dead reckoning navigation system is described. Determination of optimum initial values for Kalman filter calculation is outlined. Four computer simulation models: straight operation in constant current, ship speed reduction during operation, course change during operation, and straight operation in variable current were used for verification of system applicability. Results show that rms position error can be reduced to 1/50th of that obtained using Decca alone. Ocean current speed error can be < 0.01kt in constant current after 10 mn straight operation. In variable currents position errors are 0.003 to 0.005 nautical miles, estimates of currents are accurate to 0.1 to 0.2 kt. Author (ESA)

**N86-22562#** National Geodetic Survey, Rockville, Md.
**PERFORMING CENTIMETER-LEVEL SURVEYS IN SECONDA WITH GPS (GLOBAL POSITIONING SYSTEM) CARRIER PHASE: INITIAL RESULTS**
B. W. Remondi Oct. 1985 24 p
(PB86-125028; NOAA-TM-NOS-NGS-43) Avail: NTIS HC A02/MF A01 CSCL 17G

Two kinematic surveys were performed, using TI-4100s, which substantiate the author's earlier claim that centimeter-accuracy relative surveys can be accomplished within seconds. The first test was carried out in Arkansas using wide-bandwidth tracking. Although noisy, these data permitted the concepts and the data processing software to be verified. Based on results of this survey, a definitive kinematic survey experiment was designed and executed at the National Bureau of Standards, Gaithersburg, Md. The results of this experiment show that centimeter-level relative surveys can be performed in seconds. A prior geodetic coordinates of the initial location of the roving antenna are not required since they, too, can be determined within seconds. Author (GRA)

**N86-22566#** Joint Publications Research Service, Arlington, Va.
**CHIEF ON UNFAVORABLE YEAR FOR SOVIET AIR TRAFFIC CONTROL**
V. Shelkovnikov *In its* USSR Report: Transportation (JPRS-UTR-86-004) 12 Mar. 1986 p 1-4 Transl. into ENGLISH from Vozdushnyy Transport (Moscow, USSR), 12 Dec. 1985 p 2 (For primary document see N86-22565 13-05)
Avail: NTIS HC A05/MF A01

# 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

**N86-22563*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**COMPARISON OF MEASURED AND CALCULATED TEMPERATURES FOR A MACH 8 HYPERSONIC WING TEST STRUCTURE**
Robert D. Quinn and Roger A. Fields Mar. 1986 140 p refs
(NASA-TM-85918; H-1271; A-85137; NAS 1.15:85918) Avail: NTIS HC A07/MF A01 CSCL 01C

Structural temperatures were measured on a hypersonic wing test structure during a heating test that simulated a Mach 8 thermal environment. Measured data are compared to design calculations and temperature predictions obtained from a finite-difference thermal analysis. Author

**N86-22564#** Department of the Air Force, Washington, D.C.
**AIRCRAFT WINDOW CLAMPING DEVICE Patent Application**
James H. DeOms, inventor (to Air Force) Filed 16 Oct. 1985 13 p
(AD-D011999; US-Patent-Appl-SN-788189) Avail: NTIS HC A02/MF A01 CSCL 13/5

An aircraft window clamping ring is used to hold an optical sensor window against an aircraft wall. The ring has a plurality of cantilevers having upper contacts that bear directly down on the window. Because of the flexibility in the vertical direction, thermal expansion is compensated for by movement of the cantilevers. Horizontal expansion of the window creates no additional stress because the upper contacts bear perpendicular to possible horizontal movement. The cantilevers can be designed to preload the window to take into account maximum thermal expansion. Author (GRA)

**N86-22565#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: TRANSPORTATION**
12 Mar. 1986 92 p Transl. into ENGLISH from various Russian articles
(JPRS-UTR-86-004) Avail: NTIS HC A05/MF A01

Transportation issues in the Soviet Union are reported. Topics discussed include: civil aviation, rail systems, maritime and river fleets, ports and transshipment centers, and intersector network development. For individual titles, see N86-22566 through N86-22569.

**N86-22566#** Joint Publications Research Service, Arlington, Va.
**CHIEF ON UNFAVORABLE YEAR FOR SOVIET AIR TRAFFIC CONTROL** c04
V. Shelkovnikov *In its* USSR Report: Transportation (JPRS-UTR-86-004) 12 Mar. 1986 p 1-4 Transl. into ENGLISH from Vozdushnyy Transport (Moscow, USSR), 12 Dec. 1985 p 2 (For primary document see N86-22565 13-05)
Avail: NTIS HC A05/MF A01

Careful selection and training of air traffic controllers are discussed. The interaction process between traffic services and ground services and improvement of aircraft traffic flow planning system to raise the quality of air traffic control are emphasized. The necessary continuation of finding ways to raise flight safety in air traffic control is reiterated. Human factors in traffic service are considered. E.A.K.

**N86-22567#** Joint Publications Research Service, Arlington, Va.
**MORE ON NEW IL-96, IL-114 AIRCRAFT**
V. Inozemtsev *In its* USSR Report: Transportation (JPRS-UTR-86-004) 12 Mar. 1986 p 9-11 Transl. into ENGLISH from Nedelya (Moscow, USSR), no. 46, 11-17 Nov. 1985 p 8 (For primary document see N86-22565 13-05)
Avail: NTIS HC A05/MF A01

The development of the Ilyushin Aircraft IL-96, the long range Russian airbus, is discussed. The airbus is reminescent of the IL-86, however, its dimensions are larger and the wing span is almost 10 m greater, and the tail fin is 2 m higher. The IL-96 is a two-decked aircraft, which can hold 300 passengers. The lower deck houses 15 standard baggage handling containers. The IL-96-300 is designed to make long flights, with two or three landings in a day. The design of the 60 seat IL-114 passenger turboprop is also described. Its cruising speed is 500 km/hr, and has two multiblade gas turbine engines. It has high aircraft efficiency. It has built-in ramps. It serves short and medium distances. E.A.K.

**N86-22568#** Joint Publications Research Service, Arlington, Va.
**TUPOLEV BUREAU DEVELOPING TU-204 PASSENGER JET: TUPOLEV ON FEATURES**
Aleksey Andreyevich Tupolev and N. Dombkovskiy *In its* USSR Report: Transportation (JPRS-UTR-86-004) 12 Mar. 1986 p 12-16 Transl. into ENGLISH from Trud (Moscow, USSR), 3 Jan. 1986 p 4 (For primary document see N86-22565 13-05)
Avail: NTIS HC A05/MF A01

The design and development of the TU-204 passenger jet is discussed. The latest methods in aerodynamics, engine construction, materials science and manufacturing were incorporated in the design. The cabin has more comfortable seats and wider aisles, and the aircrafts can carry 124 passengers. The TU-204 will replace the TU-154 passenger transport plane. The plane has an on-board computer system which will reduce the number of crew members to two or three. E.A.K.

**N86-22569#** Joint Publications Research Service, Arlington, Va.
**DETAILS OF NEW Ka-126 HELICOPTER**
I. Andreyev *In its* USSR Report: Transportation (JPRS-UTR-86-004) 12 Mar. 1986 p 17-19 Transl. into ENGLISH from Izvestiya (Moscow, USSR), 29 Jan. 1986 p 1 (For primary document see N86-22565 13-05)
Avail: NTIS HC A05/MF A01

The development and construction of the Ka-126 agricultural helicopter is discussed. The Ka-126 is a modification of the older Ka-26 helicopter. The helicopter is equipped with one gas-turbine engine and its characteristics are enumerated. The economy and profitability of the helicopter are outlined. The Ka-126 is not influenced by low temperatures so that is can be utilized during the winter months. E.A.K.

**N86-22570#** Joint Publications Research Service, Arlington, Va.
**CHINA REPORT: SCIENCE AND TECHNOLOGY**
20 Feb. 1986 59 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-007) Avail: NTIS HC A04/MF A01

Progress in science and technology in the People's Republic of China is reported. Topics discussed include research and development in: computer sciences, applied sciences, acoustics, electronics, physics, and radiation protection. For individual titles, see N86-22571 through N86-22573.

**N86-22571#** Joint Publications Research Service, Arlington, Va.
**ON COMPUTER-AIDED PROGRAMMING OF PAL DEVICES**
**c61**
Xin Tao and Shuliang Pu *In its* China Report: Science and Technology (JPRS-CST-86-007) 20 Feb. 1986 p 13-26 refs Transl. into ENGLISH from Zhejiang Daxue Xuebao (Zengkan) (Hangzhou, China), 25 Jul. 1985 p 124-132 (For primary document see N86-22570 13-05)
Avail: NTIS HC A04/MF A01

Programmable Array Logic (PAL) is a new semiconductor device with powerful functions and broad applications. A PAL device programmer was designed which can be connected to any computer as long as it has a parallel interface. The hardware logic diagram and the software programming flowcharts are presented. E.A.K.

**N86-22572#** Joint Publications Research Service, Arlington, Va.
**IMPROVED Y-7, Y-12 AIRCRAFT DESCRIBED**
Shilin Bu *In its* China Report: Science and Technology (JPRS-CST-86-007) 20 Feb. 1986 p 27-29 Transl. into ENGLISH from Hangkong Zhishi (Beijing, China), no. 12, Dec. 1985 p 3 (For primary document see N86-22570 13-05)
Avail: NTIS HC A04/MF A01

The improved designs of the Y-7 and Y-12 aircrafts are described. The electronic equipment on the Y-7 was converted. The equipment included: environmental control system, atmospheric data system, ultrashortware radio station, magnetic navigation reference and attitude reference system, Omega navigation system, weather radar, guidance system, ranging device, and bearing receiver. The noise level was reduced. The interior of the Y-12 was changed and noise and vibration were reduced. The exterior was coated with high quality paint. E.A.K.

**N86-22573#** Joint Publications Research Service, Arlington, Va.
**DETAILS OF Y-121 STOL AIRCRAFT PRESENTED**
Zhaolin Song *In its* China Report: Science and Technology (JPRS-CST-86-007) 20 Feb. 1986 p 30-32 refs Transl. into ENGLISH fdrom Hangkong Zhishi (Beijing, China), no. 12, Dec. 1985 p 4-5 (For primary document see N86-22570 13-05)
Avail: NTIS HC A04/MF A01

The Y-121 is a newly developed, twin-engine turboprop, short take-off and landing multifunction airplane. It can be used for transportation, parachuting and for various applications in geology, agriculture and forestry; it can also be converted into a special-purpose airplane for precision search operation. The development design features, and technical performance of the Y-121 STOL aircraft are described. E.A.K.

# 06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

**N86-22574*#** Charles River Analytics, Inc., Cambridge, Mass.
**A PRELIMINARY DESIGN FOR FLIGHT TESTING THE FINDS ALGORITHM Final Report**
A. K. Caglayan and P. M. Godiwala Mar. 1986 85 p refs
(Contract NAS1-17719)
(NASA-CR-178043; NAS 1.26:178043; R8602) Avail: NTIS HC A05/MF A01 CSCL 01D

This report presents a preliminary design for flight testing the FINDS (Fault Inferring Nonlinear Detection System) algorithm on a target flight computer. The FINDS software was ported onto the target flight computer by reducing the code size by 65%. Several modifications were made to the computational algorithms resulting in a near real-time execution speed. Finally, a new failure detection strategy was developed resulting in a significant improvement in the detection time performance. In particular, low level MLS, IMU and IAS sensor failures are detected instantaneously with the new detection strategy, while accelerometer and the rate gyro failures are detected within the minimum time allowed by the information generated in the sensor residuals based on the point mass equations of motion. All of the results have been demonstrated by using five minutes of sensor flight data for the NASA ATOPS B-737 aircraft in a Microwave Landing System (MLS) environment. Author

**N86-22575#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
**COMPARATIVE EVALUATION OF REDUNDANT FLIGHT DATA RECORDED BY A DIGITAL AIRBORNE INTEGRATED DATA SYSTEM RECORDER (DAR) ON BOARD AN AIRBUS A-310 AIRCRAFT**
O. Weber and G. Rosenau 1985 42 p refs
Avail: NTIS HC A03/MF A01

Flight data collected during scheduled Airbus A-310 flights by a Digital AIDS Recorder (DAR) were analyzed. The characteristics of the standard A-310 AIDS are compared to those of the A-300 AIDS. The A-310 reconstruction of the motion state of the aircraft is more complete than with the older equipment. The DAR A-310 permits a detailed and extensive check of the basic AIDS measuring channels through independently measured quantities. This check, however, is restricted to the measuring ranges encountered in normal flight conditions. It cannot be extrapolated to extreme flight conditions expected in accidents or incidents. In the flight conditions of the scheduled flights, the correspondence between basic AIDS measurements and quantities from the extended AIDS is very good. Author (ESA)

# 07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

**N86-22576*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**STATIC INVESTIGATION OF CIRCULAR-TO-RECTANGULAR TRANSITION DUCTS FOR HIGH-ASPECT-RATIO NONAXISYMMETRIC NOZZLES**
James R. Burley, II, Linda S. Bangert, and John R. Carlson Mar.

1986 55 p refs
(NASA-TP-2534; L-15874; NAS 1.60:2534) Avail: NTIS HC A04/MF A01 CSCL 21E

An investigation was conducted in the static-test facility of the Langley 16-Foot Transonic Tunnel to determine the internal performance of a high-aspect-ratio nonaxisymmetric nozzle with five circular-to-rectangular transition ducts of varying design. Nozzle pressure ratio was varied from 1.5 to 5.3, and nozzle performance parameters were recorded. Author

**N86-22577#** Department of the Air Force, Washington, D.C.
**IGNITER ELECTRODE LIFE CONTROL Patent Application**
John C. Scott, inventor (to Air Force) Filed 7 Oct. 1985 11 p
(AD-D012007; US-Patent-Appl-SN-784986) Avail: NTIS HC A02/MF A01 CSCL 11/3

The prevention of electrode material erosion by undercutting in the outer electrode shell of igniter electrodes of jet engine ignition systems is prevented by the application of an electrical insulation coating. The coating is applied to the surface of the outer electrode shell which faces the ceramic insulation around the center electrode where erosion patterns are known to occur. The insulation material is selected from electrical insulation substances such as oxides of aluminum, tungsten, magnesium, beryllium or zirconium by choosing a non-porous electrical insulating substance with thermal expansion characteristics approximately equalling those of the outer electrode shell. Since a typical outer electrode shell is composed of 446 stainless steel, an optimum choice for the electrical insulation coating is Al2O3 deposited with a coating thickness of between 5 and 10 mils. Author (GRA)

**N86-22736#** Joint Publications Research Service, Arlington, Va.
**STATUE OF AIRCRAFT ENGINE RESEARCH AT NPU REVIEWED**
*In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 40-45 refs Transl. into ENGLISH from Guoji Hangkong (Beijing, China), no. 10, Oct. 1985 p 4-6 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

# 08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

**N86-22578** Tennessee Univ., Knoxville.
**INVESTIGATION OF THE DYNAMIC RESPONSE OF AIRCRAFT TO MICROBURST (JAWS) WIND SHEAR Ph.D. Thesis**
Ho-Pen Chang 1985 138 p
Avail: Univ. Microfilms Order No. DA8524117

A derivation of the governing equations of aircraft motion in variable wind field results in additional wind shear terms appearing in the force equations. Computer simulations of B727 type aircraft flying (landing and taking off) through the microburst (JAWS) wind shear data have been carried out and are in good agreement with those of the NASA/Ames B727 piloted simulator. The critical penetration heights through the center of the microburst are determined by computing the aircraft trajectory deviations from the intended flight path at the ILS Category 2 decision height window. It is found that the higher the magnitude of the wind gradient terms, the more influence they have on the aircraft performance, especially on sideslip angle, angle of attack, and rolling moment. The wind shear effects on three generic types of aircraft, a three-engine passenger airliner (PA), a twin-engines STOL (STOL), and an executive jet (EJ), are also investigated in this study. Dissert. Abstr.

**N86-22579*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A METHODOLOGY FOR AIRPLANE PARAMETER ESTIMATION AND CONFIDENCE INTERVAL DETERMINATION IN NONLINEAR ESTIMATION PROBLEMS Ph.D. Thesis - George Washington Univ., Apr. 1985**
Patrick C. Murphy Apr. 1986 56 p refs Revised
(NASA-RP-1153; L-16009; NAS 1.61:1153) Avail: NTIS HC A04/MF A01 CSCL 01C

An algorithm for maximum likelihood (ML) estimation is developed with an efficient method for approximating the sensitivities. The ML algorithm relies on a new optimization method referred to as a modified Newton-Raphson with estimated sensitivities (MNRES). MNRES determines sensitivities by using slope information from local surface approximations of each output variable in parameter space. With the fitted surface, sensitivity information can be updated at each iteration with less computational effort than that required by either a finite-difference method or integration of the analytically determined sensitivity equations. MNRES eliminates the need to derive sensitivity equations for each new model, and thus provides flexibility to use model equations in any convenient format. A random search technique for determining the confidence limits of ML parameter estimates is applied to nonlinear estimation problems for airplanes. The confidence intervals obtained by the search are compared with Cramer-Rao (CR) bounds at the same confidence level. The degree of nonlinearity in the estimation problem is an important factor in the relationship between CR bounds and the error bounds determined by the search technique. Beale's measure of nonlinearity is developed in this study for airplane identification problems; it is used to empirically correct confidence levels and to predict the degree of agreement between CR bounds and search estimates. Author

**N86-22580*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**LOW-SPEED STABILITY AND CONTROL CHARACTERISTICS OF A TRANSPORT MODEL WITH AFT-FUSELAGE-MOUNTED ADVANCED TURBOPROPS**
Zachary T. Applin and Paul L. Coe, Jr. Apr. 1986 67 p refs
(NASA-TP-2535; L-16004; NAS 1.60:2535) Avail: NTIS HC A04/MF A01 CSCL 01C

A limited experimental investigation was conducted in the Langley 4- by 7-Meter Tunnel to explore the effects of aft-fuselage-mounted advanced turboprop installations on the low-speed stability and control characteristics of a representative transport aircraft in a landing configuration. In general, the experimental results indicate that the longitudinal and lateral-directional stability characteristics for the aft-fuselage-mounted single-rotation tractor and counter-rotation pusher propeller configurations tested during this investigation are acceptable aerodynamically. For the single-rotation tractor configuration, the propeller-induced aerodynamics are significantly influenced by the interaction of the propeller slipstream with the pylon and nacelle. The stability characteristics for the counter-rotation pusher configuration are strongly influenced by propeller normal forces. The longitudinal and directional control effectiveness, engine-out characteristics, and ground effects are also presented. In addition, a tabulated presentation of all aerodynamic data presented in this report is included as an appendix. Author

**N86-22581*#** Information and Control Systems, Inc., Hampton, Va.
**EXTENSIONS TO PIFCGT: MULTIRATE OUTPUT FEEDBACK AND OPTIMAL DISTURBANCE SUPPRESSION**
John R. Broussard Mar. 1986 121 p refs
(Contract NAS1-17493)
(NASA-CR-3968; NAS 1.26:3968; IR-684105) Avail: NTIS HC A06/MF A01 CSCL 01C

New control synthesis procedures for digital flight control systems were developed. The theoretical developments are the solution to the problem of optimal disturbance suppression in the presence of windshear. Control synthesis is accomplished using a linear quadratic cost function, the command generator tracker for trajectory following and the proportional-integral-filter control structure for practical implementation. Extensions are made to the optimal output feedback algorithm for computing feedback gains

so that the multirate and optimal disturbance control designs are computed and compared for the advanced transport operating system (ATOPS). The performance of the designs is demonstrated by closed-loop poles, frequency domain multiinput sigma and eigenvalue plots and detailed nonlinear 6-DOF aircraft simulations in the terminal area in the presence of windshear. E.A.K.

**N86-22582*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**THE MEASUREMENT OF AIRCRAFT PERFORMANCE AND STABILITY AND CONTROL AFTER FLIGHT THROUGH NATURAL ICING CONDITIONS**
Richard J. Ranaudo, Kevin L. Mikkelsen, Robert C. McKnight, Robert F. Ide, Andrew L. Reehorst, Jerry L. Jordan, William C. Schinstock, and Stewart J. Platz [1986] 46 p refs Presented at the 3rd Flight Testing Conference, Las Vegas, Nev., 2-4 Apr. 1986; cosponsored by AIAA, CASI, DGLR, IES, ISA, ITEA, SETP, and SFTE Prepared in cooperation with Kohlman Systems Research, Inc., Lawrence, Kansas
(NASA-TM-87265; E-2962; NAS 1.15:87265; AIAA-86-9758) Avail: NTIS HC A03/MF A01 CSCL 01C

The effects of airframe icing on the performance and stability and control of a twin-engine commuter-class aircraft were measured by the NASA Lewis Research Center. This work consisted of clear air tests with artificial ice shapes attached to the horizontal tail, and natural icing flight tests in measured icing clouds. The clear air tests employed static longitudinal flight test methods to determine degradation in stability margins for four simulated ice shapes. The natural icing flight tests employed a data acquisition system, which was provided under contract to NASA by Kohlman Systems Research Incorporated. This system used a performance modeling method and modified maximum likelihood estimation (MMLE) technique to determine aircraft performance degradation and stability and control. Flight test results with artificial ice shapes showed that longitudinal, stick-fixed, static margins are reduced on the order of 5 percent with flaps up. Natural icing tests with the KSR system corroborated these results and showed degradation in the elevator control derivatives on the order of 8 to 16 percent depending on wing flap configuration. Performance analyses showed the individual contributions of major airframe components to the overall degration in lift and drag. Author

**N86-22583#** European Space Agency, Paris (France).
**ROBUSTNESS OF DISCRETE-TIME DYNAMICAL SYSTEMS: APPLICATION TO THE MULTIVARIABLE DIGITAL CONTROL OF COMBAT AIRCRAFT**
Yves Joannic Oct. 1985 266 p refs Transl. into ENGLISH of "La Robustesse des Systemes Dynamiques a Temps Discret: Application au Pilotage Numerique Multivariable des Avions d'Armes" Rept. ONERA-NT-1984-2 ONERA, Paris, France, 1984 Original language document was announced as N85-19986
(ESA-TT-906; ONERA-NT-1984-2) Avail: NTIS HC A12/MF A01

A method for computing optimal feedback laws, capable of maintaining accurate tracking despite constantly acting disturbances was developed and applied to flight control of combat aircraft. A formalism reduces robustness to preservation of stability in a properly augmented system. This leads to theoretical results which quantify the generalized structural robustness of a recurrent nonlinear multiple-loop system. After extending the Lyapunov criterion to systems having dynamical feedback, the classical concepts of stability margin and of gain and phase margins are generalized to the multivariable discrete case. Analytical expressions which enable margins to be evaluated when dynamical or nonlinear perturbations affect the feedback channels are given. By applying theorems on external stability to a recurrent system, the tolerable additive perturbations which do not destabilize the controlled system are quantified. Author (ESA)

# 09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

**N86-22737#** Joint Publications Research Service, Arlington, Va.
**SHANGHAI'S OUTDOOR AEROENGINE TEST FACILITY DETAILED**
*In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 46-50 Transl. into ENGLISH from Hangkong Zhizao Gongcheng (Beijing, China), no. 7, 1 Jul. 1985 p 1-4 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

# 12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

No abstracts in this category.

# 13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

**N86-22584#** Royal Aircraft Establishment, Farnborough (England).
**ORBIT DETERMINATION AND ANALYSIS FOR 1970-97B AT 14TH-ORDER RESONANCE**
A. N. Winterbottom and D. G. King-Hele 3 Jun. 1985 24 p refs (RAE-TR-85054; RAE-Space-646; BR96950) Avail: NTIS HC A02/MF A01

The orbit of the satellite 1970-97B, the rocket of Cosmos 378, at inclination 74 deg, has been determined at 18 epochs between April and August 1971, when the effects of 14th-order resonance with the Earth's gravitational field were appreciable. The orbits were determined with the PROP 6 program from Hewitt camera, kinetheodolite, US Navy and visual observations, and an average accuracy of 90 m in perigee distance was achieved, despite the low perigee height (near 230 km) and the consequent high drag. The orbits, together with 13 previously evaluated, have been analyzed to reveal the effects of the 14th-order resonance and to evaluate six lumped geopotential harmonics of order 14. Because the orbit passed through resonance rapidly, the values are not as accurate as those from slow resonances; but they are more accurate than any others available for an inclination near 74 deg, and have proved their worth in a recent determination of individual 14th-order coefficients. Author (ESA)

**N86-22585*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**COSPAS-SARSAT SATELLITE ORBIT PREDICTOR, VOLUME 6 Report, October 1985 - April 1986**
Morton L. Friedman Oct. 1985 106 p
(NASA-TM-85015; NAS 1.15:85015) Avail: NTIS HC A06/MF A01 CSCL 22A

The satellite orbit predictor is a graphical aid for determining the relationship between the satellite (SARSAT or COSPAS) orbit, antenna coverage of the spacecraft and coverage of the Local User Terminal (LUTs). The predictor allows the user to quickly visualize if a selected position will probably be detected and is composed of a base map and a satellite track overlay for each

satellite. Additionally, a table of equator crossings for each satellite is included. Author

**N86-22586#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**SATELLITE-TO-SATELLITE TRACKING WITH POPSAT AND AN ERS-CLASS SATELLITE. MISSION AND SYSTEM ASSESSMENT STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report**
B. Schuerenberg, L. Popken, H. Schuessler, R. Ockert, Ch. Reigber (Deutsches Geodaetisches Forschungsinstitut), E. C. Pavlis (Deutsches Geodaetisches Forschungsinstitut), J.-C. Raimondo (Deutsches Geodaetisches Forschungsinstitut), H. Mueller (Deutsches Geodaetisches Forschungsinstitut), K. F. Wakker (Tech. Univ., Delft), B. A. C. Ambrosius (Tech. Univ., Delft) et al Paris ESA Jun. 1985 61 p refs 3 Vol.
(Contract ESA-5715/83-NL-MS)
(ESA-CR(P)-2105-Vol-1) Avail: NTIS HC A04/MF A01

Orbit determination error analyses were carried for satellite-to-satellite tracking (SST) alternatives, on global and local scales. It is shown that radial orbit determination accuracies in the range of interest for radar altimetry applications can be achieved. Error analyses show that imperfect knowledge of the Earth gravity field introduces the dominant error contribution. Tracking concepts for precise low Earth orbit determination must be judged by their capability to provide accurately tailored gravity field models. Although the ultimate accuracy limits of gravity field determination are not established, deterministic simulations demonstrate that SST from POPSAT is the superior method for setting up dedicated gravity field models for LEO satellites and that improvements by a factor of six compared to SEASAT appear achievable. The selected SST concept was functionally defined. The performance of the S-band intersatellite link was analyzed and error budgets were set up. Author (ESA)

**N86-22587#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**SATELLITE-TO-SATELLITE TRACKING WITH POPSAT AND AN ERS-CLASS SATELLITE. MISSION AND SYSTEM ASSESSMENT STUDY. VOLUME 2: TECHNICAL RESULTS Final Report**
B. Schuerenberg, L. Popken, H. Schuessler, R. Ockert, Ch. Reigber (Deutsches Geodaetisches Forschungsinstitut), E. C. Pavlis (Deutsches Geodaetisches Forschungsinstitut), J.-C. Raimondo (Deutsches Geodaetisches Forschungsinstitut), H. Mueller (Deutsches Geodaetisches Forschungsinstitut), K. F. Wakker (Tech. Univ., Delft), B. A. C. Ambrosius (Tech. Univ., Delft) et al Paris ESA Jun. 1985 416 p refs 3 Vol.
(Contract ESA-5715/83-NL-MS)
(ESA-CR(P)-2105-Vol-2) Avail: NTIS HC A18/MF A01

Orbit determination error analyses were carried for satellite-to-satellite tracking (SST) alternatives, on global and local scales. It is shown that radial orbit determination accuracies in the range of interest for radar altimetry applications can be achieved. Error analyses show that imperfect knowledge of the Earth gravity field introduces the dominant error contribution. Tracking concepts for precise low Earth orbit determination must be judged by their capability to provide accurately tailored gravity field models. Although the ultimate accuracy limits of gravity field determination are not established, deterministic simulations demonstrate that SST from POPSAT is the superior method for setting up dedicated gravity field models for LEO satellites and that improvements by a factor of six compared to SEASAT appear achievable. The selected SST concept was functionally defined. The performance of the S-band intersatellite link was analyzed and error budgets were set up. Author (ESA)

**N86-22588#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**SATELLITE-TO-SATELLITE TRACKING WITH POPSAT AND AN ERS-CLASS SATELLITE. MISSION AND SYSTEM ASSESSMENT STUDY. VOLUME 3: DEVELOPMENT PROGRAM Final Report**
B. Schuerenberg, L. Popken, H. Schuessler, R. Ockert, Ch. Reigber (Deutsches Geodaetisches Forschungsinstitut), E. C. Pavlis (Deutsches Geodaetisches Forschungsinstitut), J.-C. Raimondo (Deutsches Geodaetisches Forschungsinstitut), H. Mueller (Deutsches Geodaetisches Forschungsinstitut), K. F. Wakker (Tech. Univ., Delft), B. A. C. Ambrosius (Tech. Univ., Delft) et al Paris ESA Jun. 1985 25 p refs 3 Vol.
(Contract ESA-5715/83-NL-MS)
(ESA-CR(P)-2105-Vol-3) Avail: NTIS HC A02/MF A01

The development program required for a satellite-to-satellite tracking (SST) mission is outlined. System elements are described in terms of needed hardware and software functions. Integration of the SST development program into the POPSAT development program and that of a typical LEO satellite is described. Verification aspects (from simulations up to final verification with the operational system) are covered. Author (ESA)

**N86-22774#** Joint Publications Research Service, Arlington, Va.
**CALCULATING INTERCONTINENTAL VEHICLE RANGE, ACCURACY**
Yongfang Cai *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 129-133 refs Transl. into ENGLISH from Shuxue de Shijian yu Renshi (Beijing, China), no. 3, Jul. 1985 p 1-4 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

# 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

**N86-22589#** European Space Tribology Lab., Risley (England).
**THE ESTL POINTING MECHANISM TEST FACILITY**
E. W. Roberts and F. Golding Paris ESA Apr. 1985 52 p ref
(Contract ESA-5615/83-NL-PP)
(ESA-ESTL-74; ESA-CR(P)-2096) Avail: NTIS HC A04/MF A01

A test facility for assessment of spacecraft pointing mechanisms operating in ambient or thermal vacuum conditions over the temperature range minus 40 to plus 80 C was developed. The system employs vacuum-compatible sensors (inclinometers) to measure tilt angles statically and a laser-optics system for the dynamic measurement of small changes of tilt angle. In static measurements, the system displays high accuracy (+ or - 0.001 deg over the angular range + or - 7 deg); high resolution (0.0004 deg) and good repeatability (+ or - 0.0005 deg) and maintains these qualities over the full operational temperature range. In dynamic measurements over small angles (+ or - 0.5 deg), the system is capable of high resolution (0.0002 deg). To demonstrate the facility, tests were carried out on a breadboard pointing mechanism (based on the swash-plate principle) which, because of its prototype nature, was not built to the accuracies demanded of flight standard equipment. The assessment shows that the inherent errors of the mechanism are readily resolved by the test facility. Author (ESA)

**N86-22601*#** National Aeronautics and Space Administration. White Sands Test Facility, N. Mex.
**MATERIALS TEST LABORATORY ACTIVITIES AT THE NASA-JOHNSON SPACE CENTER WHITE SANDS TEST FACILITY (WSTF)**
J. Stradling and D. L. Pippen *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials Space Environment Nov. 1985 p 71-74 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-23181#** Libyan Arab Jamahiriya, Tripoli. Meteorological Dept.
**POTENTIAL EVAPORATION IN DIFFERENT PARTS OF LIBYA**
S. E. Hassan *In* WMO Casebook of Operational Assessment of

Areal Evaporation 1985 p 186-194 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

# 15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

**N86-22590** Department of the Army, Washington, D. C.
**SSICM (SPIN STABILIZED IMPULSIVELY CONTROLLED MISSILE) GUIDANCE AND CONTROL CONCEPT Patent**
W. Max Howell, inventor (to Army) Issued 24 Sep. 1985 8 p (AD-D011970; US-Patent-4,542,870; US-Patent-Appl-SN-521490; US-Patent-Class-244-3.15) Avail: US Patent and Trademark Office CSCL 17/7

The guidance scheme utilizing wide beam width semiactive RF sensors, a precision roll attitude reference, and a controlled grade pitch, yaw and roll rate gyros to deliver high quality homing guidance information to a spin stabilized controlled missile is presented. A filtering system is utiiized to eliminate errors caused by body roll signals generated due to the spin of the missiles. The nutational motion is used to calibrate the sensors. Impulsive maneuvers are utilized to intercept incoming ballistic targets. GRA

**N86-22591#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**AN APPROXIMATE FLIGHT PROFILE OF AN ARIANE LAUNCH VEHICLE Progress Report [EEN BENADERD VLUCHTPROFIEL VAN EEN ARIANE-DRAAGRAKET. VOORTGANGSRAPPORT 7]**
B. Dijkshoorn Apr. 1983 49 p Partly in DUTCH and ENGLISH (VTH-M-462; PR-7) Avail: NTIS HC A03/MF A01

The flight trajectory of an Ariane launch vehicle, launched from Kourou (French Guyana) to put the satellites MARECS-B and SIRIO-2 in a geostationary transfer orbit, was approximated. The calculation was carried out to subject a panel 24 m from the nose to a heat flow, corresponding to the heat flow from the boundary layer in real flight. Height, flight speed (relative to the surrounding atmosphere) air density, dynamic pressure, air temperature, and Mach number were determined every 10 sec as a function of time from lift-off until the stopping of the rocket engines of the first stage 143.9 sec afterwards. Heat flow calculations show good agreement with published data.
Author (ESA)

# 16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

# 17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

**N86-22805*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ICE TELEMETRY PERFORMANCE**
J. W. Layland *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 203-213 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 09F

# 18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

**N86-22592#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**TRUNCATED ELASTIC MODES COUPLING EFFECTS MINIMIZATION METHOD BY USING SPECIAL ATTITUDE CONTROL SCHEME**
Decio Castilho Ceballos and Atair Rios Neto Jan. 1986 9 p refs Presented at the 3rd Internation Modal Analysis Conference, Orlando, Fla., Jan. 1985
(INPE-3782-PRE/880) Avail: NTIS HC A02/MF A01

An adaptive scheme is applied to minimize the truncated modes coupling effects for the attitude controlled spacecraft. The basic idea for the scheme is to nullify the accumulated effect of the truncated modes by using a correction in the control, such as to induce the physical system to have a behavior close to the model of work used in the synthesis and implementation of the control. This nullification provides the decoupling of the truncated modes from the work model. It is the decoupling that makes the truncated modes associated eigenvalues be identical for the controlled and constrained model. The importance of the result is that the eigenvalues for the constrained model are stable and frequently present a reasonable damping time. The proposed scheme is very easy to be implemented in on board control. The procedure was tested for the attitude control of a flexible spacecraft and the obtained results are presented. Author

**N86-22593#** European Space Agency, Paris (France).
**PROCEEDINGS OF THIRD EUROPEAN SYMPOSIUM ON SPACECRAFT MATERIALS IN SPACE ENVIRONMENT**
T. D. Guyenne, comp. and J. J. Hunt, comp. Nov. 1985 293 p refs Symposium held in Noordwijk, Netherlands, 1-4 Oct. 1985; sponsored by ESA, CNES, and Centre d'Etudes et de Recherches de Toulouse
(ESA-SP-232; ISSN-0379-6566) Avail: NTIS HC A13/MF A01

Spacecraft contamination; material behavior in low orbit; spacecraft charging; composite materials; and thermal control materials were discussed. For individual titles, see N86-22594 through N86-22626.

**N86-22594*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**COMPOSITE MATERIALS FOR SPACE STRUCTURES c24**
D. R. Tenney, G. F. Sykes, and D. E. Bowles *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environments Nov. 1985 p 9-21 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The use of advanced composites for space structures is reviewed. Barriers likely to limit further applications of composites are discussed and highlights of research to improve composites are presented. Developments in composites technology which could impact spacecraft systems are reviewed to identify technology needs and opportunities. Author (ESA)

**N86-22595#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Materi-

als Section.

**OUTGASSING AND CONTAMINATION MODEL BASED ON RESIDENCE TIME**

M. vanEesbeek and A. Zwaal *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 25-34 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The long duration contamination and pressure predictions for the HIPPARCOS telescope are described. Multitemperature outgassing tests were performed to accelerate the outgassing phenomena. From these tests the acceleration factors and the residence times of the outgassing species were determined. The contamination and pressure model is based upon the outgassing rates, the residence times, and geometric parameters.
Author (ESA)

**N86-22596#** Centre National d'Etudes Spatiales, Toulouse (France).

**EVALUATION OF ISOTHERMAL OUTGASSING KINETICS FOR SOME MATERIALS USED IN SPACE**

J. Guillin *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 35-38 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Spacecraft material outgassing prediction using quartz crystal microbalances is described and data are presented. Data concern thermal control coatings, an adhesive film, an electrical wire, a carbon fiber reinforced plastic, and an adhesive. Kinetic parameters of outgassing required for modeling contamination assessment are discussed. It is assumed that the outgassing source involves several components and these are emitted according to order one of reaction. Author (ESA)

**N86-22597#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

**PHOTO-ENHANCED SPACECRAFT CONTAMINATION DEPOSITION**

D. F. Hall, T. B. Stewart, and R. R. Hayes (Hughes Aircraft Corp., El Segundo, Calif.) *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 39-47 refs (For primary document see N86-22593 13-18)
(Contract AFOSR-F04701-83-C-0084)
Avail: NTIS HC A13/MF A01

Contaminant molecule adhesion to sunlit spacecraft surfaces, particularly radiators, was examined in laboratory experiments to determine the magnitude of this phenomenon and to study the underlying photochemical processes. Flight and laboratory evidence indicates that photolysis plays an important role in the deposition of contamination on spacecraft surfaces. The implications of this effect for the spacecraft contamination community are discussed.
Author (ESA)

**N86-22598#** MATRA Service Aerodynamique, Toulouse (France).

**THE HIPPARCOS CLEANLINESS POLICY**

S. Volf and A. Zwaal (ESA/ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment 13 Nov. 1985 p 49-54 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The approach to molecular and particular contamination on the HIPPARCOS satellite is outlined. The simulation program indicates that the molecular contamination prediction of 0.0000005 g/sqcm is met. For particles > 1 micron the results are satisfactory. Further analyses and tests for particles < 1 micron are needed.
Author (ESA)

**N86-22599#** Centre Suisse de Documentation dans le Domaine de la Microtechnique, Neuchatel.

**CODUST: A NEW CONCEPT FOR A QUARTZ CRYSTAL MICROBALANCE** c35

J. Sekler, H. E. Hintermann, and A. Zwaal (ESA/ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 55-58 refs (For primary document see N86-22593 13-18)
(Contract ESTEC-4907/81)
Avail: NTIS HC A13/MF A01

Problems with commercially available quartz crystal microbalances were investigated and the sources of major difficulties identified. The analysis shows the importance of a correct measurement of the real crystal temperature and of an efficient heat transfer control between crystal and cooling/heating elements. Methods to improve the existing concept are proposed. A prototype model proving feasibility was constructed. Author (ESA)

**N86-22600#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Materials Section.

**THE SUMMATION OF THE OFFGASSING CHARACTERISTICS OF A TOTAL SPACELAB PAYLOAD**

P. Jollet and M. D. Judd *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 63-69 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The requirement imposed on equipment to fly on board Spacelab that materials should have low offgassing characteristics (i.e., not release potentially toxic contaminants into the surrounding atmosphere) is discussed. Compliance with this requirement may be shown by tests either on materials or at black box level. In order to maintain visibility on the overall payload offgassing, a computational approach which enables specific offgassing data to be located at defined positions within a payload was developed. Full traceability through experiment facility/rack and payload is ensured together with data recall either by rack etc., or contaminant. Author (ESA)

**N86-22601*#** National Aeronautics and Space Administration. White Sands Test Facility, N. Mex.

**MATERIALS TEST LABORATORY ACTIVITIES AT THE NASA-JOHNSON SPACE CENTER WHITE SANDS TEST FACILITY (WSTF)** c14

J. Stradling and D. L. Pippen *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials Space Environment Nov. 1985 p 71-74 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The NASA Johnson Space Center White Sands Test Facility (WSTF) performs aerospace materials testing and evaluation. Established in 1963, the facility grew from a NASA site dedicated to the development of space engines for the Apollo project to a major test facility. In addition to propulsion tests, it tests materials and components, aerospace fluids, and metals and alloys in simulated space environments. Author (ESA)

**N86-22602*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Materials Branch.

**EFFECTS OF THE LOW EARTH ORBITAL ENVIRONMENT ON SPACECRAFT MATERIALS**

L. J. Leger *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 75-80 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Recession of organic-polymer-based surfaces due to oxidation by atomic oxygen, the major component of the LEO environment, was studied in Space Shuttle flights 5, 8, and 41-G to measure reaction rates and the effects of various parameters on reaction rates. Surface recession on the flights indicates reaction rates of 3 x10 to the minus 24th power cc atom for unfilled organic polymers. Application of these rates to Space Station-type exposure for main structural items indicates that as much as 0.075 cm of surface recession occurs in 30 yr. Because of the importance of this effect on Space Station systems, additional experiments are planned to obtain better reaction rate measurements ensuring and adequate data base for Space Station design. Author (ESA)

**N86-22603*#** Communications Research Centre, Ottawa (Ontario).

**THE EFFECT OF LOW EARTH ORBIT SPACE ENVIRONMENT**

**ON POLYMERIC SPACECRAFT MATERIALS**

D. G. Zimcik, R. C. Tennyson (Toronto Univ., Ontario), L. J. Kok (Toronto Univ., Ontario), and C. R. Maag (JPL, Pasadena, Calif.) *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 81-89 refs Sponsored by NASA (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The Advanced Composite Materials Exposure to Space Experiment flown on shuttle mission STS-41G was designed to investigate the effect of low Earth orbit space environment on polymeric spacecraft materials. The effect of the phenomenon attributed to atomic oxygen on Kapton and advanced composite materials of carbon-epoxy and kevlar epoxy is described. The results of true space exposure are compared to duplicate specimens subjected to a simulated environment in an Earth-based nozzle beam test facility utilizing microwave discharge to form atomic oxygen. Although the energy level for atomic oxygen in the beam facility did not achieve the orbital energy level of 5 eV, similar effects of surface erosion and degradation are observed after equivalent exposure times. Author (ESA)

**N86-22604#** Lockheed Aircraft Corp., Palo Alto, Calif.

**LABORATORY INVESTIGATION OF THE STABILITY OF ORGANIC COATINGS FOR USE IN A LEO ENVIRONMENT**

M. McCargo, R. A. Dammann, T. Cummings, and C. Carpenter *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 91-97 refs Sponsored by LMSC (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The results of a laboratory investigation of protective coatings, and of the use of an oxygen plasma reactor to generate engineering data related to the orbit lifetime of the coated substrates are discussed. Changes in the surface optical and morphological properties and the rate of material mass loss are presented. Possible modes of degradation are suggested to explain the observed effects. Laboratory data are correlated with the flight data from shuttle missions, Solar Maximum Mission (SMM), and an experimental flight package. Author (ESA)

**N86-22605#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Materials Section.

**THE DEGRADATION OF METAL SURFACES BY ATOMIC OXYGEN** **c26**

A. deRooy *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 99-108 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The influence of atomic oxygen on erosion-corrosion of metal surfaces, especially silver, is examined. Protection schemes for silver are investigated. Bare silver samples and partly coated silver samples were exposed to low Earth orbit conditions during shuttle flights STS-8 and STS-17. The silver specimens decrease 3 to 4.5 microns in thickness depending on the relative position to the velocity vector. The examination of the coated silver samples shows that 500 nm palladium, 50 nm aluminum and silicone DC6-1104 are successful in protecting the underlying silver against atomic oxygen attack. Author (ESA)

**N86-22606#** Centre d'Etudes et de Recherches, Toulouse (France). Dept. Technologie Spatiale.

**CONDUCTIVITY AND SECONDARY EMISSION PROPERTIES OF DIELECTRICS AS REQUIRED BY NASCAP**

L. Levy, D. Sarrail, and J. M. Siguier *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 113-123 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Spacecraft charging modeling by the computational code NASCAP is discussed. Conductivity and secondary emission are reviewed. Measurements methods and laboratory experiments are described. Results for commonly used external coatings are given. The impact of material properties on electrostatic behavior is illustrated. Author (ESA)

**N86-22607#** United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

**CONDUCTIVE COATINGS TO MINIMISE THE ELECTROSTATIC CHARGING OF KAPTON** **c27**

D. Verdin and M. J. Duck *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 125-131 refs Sponsored by UK Ministry of Defence Procurement Executive (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

To reduce electrostatic charging of Kapton under electron irradiation, coatings with In2O3:polyimide ratios of up to 12:1 by weight and having a surface resistivity in the range 20,000 to 10 million ohm/sq and an alpha s/epsilon value of 0.63 were produced. These materials hold the surface below 250V during electron irradiation. The adhesion is 100% and does not deteriorate after 1100 cycles between +150 and -150 C; coatings prepared at 225 deg C exhibit negligible volatile material losses. The coatings are easily and economically prepared and may offer a practicable alternative to modified forms of Kapton when it is necessary to minimize its electrostatic charging. Author (ESA)

**N86-22608#** AEG-Telefunken, Wedel (West Germany).

**DEVELOPMENTS OF SOLAR GENERATOR SUBSTRATES: SIMPLE ANTICHARGING (AC) AND CONDUCTIVE THERMAL CONTROL (TC) MATERIALS (GEO), AND SOME LEO ASPECTS** **c44**

W. Schmitz *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 133-141 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Development work performed during the design phase for a large flexible solar blanket (L-SAT) requiring protection against electrostatic discharge anticharging (AC) on the whole substrate rearside and thermal control in certain blank (cell free) areas on the frontside is described. Efforts focused on the compromise with regard to conductivity (particularly important for AC) and thermooptical behavior and on the need for a simple solution concerning workability and adaptability. Soot and silver dispersions are discussed. Author (ESA)

**N86-22609#** AEG-Telefunken, Frankfurt am Main (West Germany). Forschungsinst.

**ON DIELECTRIC LONG TERM STABILITY OF KAPTON-FILMS STRESSED BY ac AND dc UNDER USUAL ATMOSPHERIC CONDITIONS AND IN VACUUM** **c27**

W. Goelz *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 143-148 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Voltage life curves of ac stressed polyimide films in accordance with Dakin's theory of voltage endurance were found. A first approximation of the characteristic parameters can be calculated directly from short time experiments with the threshold voltage obtained by a partial discharge detector. At ambient atmospheric pressure, as well as under vacuum, the inception of partial discharges is considered indicative for limited long term operation. Although the identification of the true threshold voltage of solar generators insulation layers may become difficult in high vacuum, and especially under dc stress, it is assumed to be well beyond the level of 1000 V. Author (ESA)

**N86-22610#** Imperial Chemical Industries, Wilton (England). New Science Group.

**MECHANICAL AND FIRE PROPERTIES OF AROMATIC POLYMER COMPOSITES** **c27**

D. C. Leach, P. J. Briggs, and D. R. Carlile *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 153-160 refs (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

Mechanical and fire properties of aromatic polymer composite APC-2 are discussed. Room temperature tensile properties of APC-2 are equivalent to or greater than those of a typical, thermosetting matrix composite using the same carbon fiber reinforcement. In damage tolerance, APC-2 shows significant improvements over thermosetting composites due to the high interlaminar fracture toughness of APC-2. The changes in mechanical properties with temperature are not large and even above the glass transition temperature of the Victrex PEEK matrix, APC-2 retains good mechanical performance due to the semicrystalline nature of the polymer. It is difficult to ignite and exhibits low flame propagation rates in standard laboratory tests. Flame penetration times at temperatures > 1000 C are significantly longer for APC-2 sheets than for aluminum alloy sheets. Smoke and toxic emission from APC-2 during a fire is amongst the lowest of all plastics. Author (ESA)

**N86-22611#** Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Etablissement d'Aquitaine.

**HOLOGRAPHY: THE NONDESTRUCTIVE TESTING OF COMPOSITE STRUCTURES c35**

P. Barbier and C. LeFloch *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 161-165 refs (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

The principle of nondestructive testing by laser holographic interferometry, and the parts to be controled (parts of motor cases in composite materials) are discussed. The test facility, which involves a complex mechanical system, is described and the technical choices are justified. The economic aspects of the technique are outlined. Author (ESA)

**N86-22612#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**DEVELOPMENT OF STRUCTURAL-COMPOSITE REFLECTOR PANELS FOR A SUBMILLIMETER SPACE TELESCOPE c24**

R. E. Freeland *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 167-172 refs Sponsored by NASA (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

Reflector panels for the Large Deployable Reflector (LDR) for a 20m, Earth-orbiting, submillimeter and infrared telescope were designed. The panels must be 1 to 2 m in diameter with surface precision and thermal stability of a few microns, and an areal density of < or = 10 kg/sqm. Using a combination of design, analytical modeling, panel fabrication, and testing, two sizes of graphite/epoxy panels were produced. One is 15 sqcm the other 60 sqcm, both weighing 5 to 7 kg/sqm with manufactured surface accuracies of a few tenths of a micron and thermal stability at LDR orbital temperatures of a few microns. Author (ESA)

**N86-22613#** Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).

**WINDING WITH THERMOPLASTIC POLYMERS c27**

J. L. Tisne and J. Bouvard *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 173-178 refs Sponsored by ESA (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

Thermoplastic materials properties are compared to high temperature epoxy resins. Advantages in composite material manufactured by winding of continuous fiber with thermoplastic matrix are outlined. Processing problems are pointed out. Work to be done for space applications is discussed. Author (ESA)

**N86-22614#** Societe Nationale Industrielle Aerospatiale, Cannes (France).

**DIMENSIONAL STABILITY OF CARBON-EPOXY COMPOSITE MATERIALS c24**

V. Baudinaud and L. Massoni *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 179-184 ref (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

Temperature and moisture effects on the dimensional stability of carbon-epoxy composites are discussed, and test facilities to quantify the effects are described. To measure thermal expansion proper, it proved necessary to implement a laser interferometric method. Measurements can be made from minus 80 to plus 80 C. Two dilatometers placed in a programmable climatic chamber study temperature and moisture effects. Author (ESA)

**N86-22615#** Centre National d'Etudes Spatiales, Toulouse (France).

**METAL MATRIX COMPOSITE MATERIALS FOR STRUCTURAL APPLICATIONS c24**

Ph. Roy and A. Mamode *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 185-190 refs (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

A program to develop metal matrix composites for spacecraft structures is described. A prepeg showing adequate characteristics was made. Shaped pieces were manufactured in parallel, allowing the acquisition of the processes and characterization of the pieces. The manufacture of complex pieces such as tubes and gussets, made from C/Al and C/Mg, is envisaged. Using tubes and gussets, a structural assembly (truss) will be built and fully tested. When C/Mg elaboration is optimized, an industrial elaboration solution will be sought in order to achieve sufficient production of metal matrix composites in Europe, having quite good dimensional stability characteristics. Author (ESA)

**N86-22616#** Alcan International Ltd., London (England).

**THE DEVELOPMENT OF ALUMINUM-LITHIUM ALLOYS FOR AEROSPACE APPLICATIONS c26**

A. J. Cornish, A. Gray, W. S. Miller, and M. A. Reynolds *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 195-201 refs (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

The development of aluminum-lithium based alloys is described by considering the reasons for the rapid growth of interest in the alloy type, the property targets sought, the compositions on which the major effort is concentrated, the properties achieved, and manufacturing. The objective is to achieve a 10% reduction in density relative to standard high strength alloys, together with a 10% increase in stiffness, while matching the strength and other service properties associated with the standard alloys. Two aluminum-lithium based alloys are under development to match the service properties of alloys in the 2000 and 7000 series. One alloy is used in different tempers, either to match the properties of the medium strength alloy 2014 T6 or to give a low density replacement for the damage tolerant alloy 2024 T3. The second has a higher strength and matches the properties of 7075 T6. Author (ESA)

**N86-22617#** Societe Crouzet, Valence (France).

**ADVANCED PRINTED WIRING BOARD (PWB) MATERIALS FOR SURFACE MOUNTED DEVICES IN AEROSPACE APPLICATIONS c33**

G. Menozzi *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 203-213 refs Sponsored by CNES (For primary document see N86-22593 13-18)

Avail: NTIS HC A13/MF A01

Multilayer thick film hybrid and printed wiring board technologies for leadless ceramic chip carriers (LCCC) were developed. Copper clad invar MLBs prove to be a viable solution for LCCC interconnects. The CIC core MLB offers advantages such as large size, both-side mounting, an inner thermal plane for thermal management, an easier rework process, and better vibration tolerance. One disadvantage is the weight. Thermal coefficient of expansion measurements and calculations offer a quick approach

for material inspection and assembly evaluation. The thermal cycling test from minus 55 to plus 125 C widely used for evaluation programs consisting of several hundred cycles is not realistic for aerospace qualification tests. Author (ESA)

**N86-22618#** Du Pont (UK) Ltd., Stevenage (England).
**MULTILAYER PRINTED CIRCUIT BOARD CHARACTERIZATION BY THERMAL ANALYSIS** **c33**
J. N. Leckenby *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 215-222 refs Sponsored by International Computers Ltd., Kidsgrove, England and Fortin Industries Inc., Sylmar, Calif. (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Thermal analysis techniques used to test multilayer printed circuit boards are described. Differential scanning calorimetry laminate cure determination; thermomechanical analysis (TMA) delamination testing; gel time and resin flow determination by TMA; dynamic mechanical analysis (DMA) prepreg cure determination; cured laminate determination by DMA; thermogravimetric analysis (TGA) compositional analysis; and thermal stability kinetic studies by TGA are covered. Author (ESA)

**N86-22619#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**HIGH VOLTAGE POTTING FOR THE FAINT OBJECT CAMERA (FOC)** **c35**
R. Thomas *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 223-228 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Potting the high voltage parts on the photon detector of the Faint Object Camera (FOC) for the Space Telescope is described. The detector is required to have very high gain to provide a logic level signal for digital processing. Gain is provided by an image intensifier and a video camera tube, the former operating at up to 42KV (normally at 38KV) and the latter in the range -6.5 to -12KV (normally -10KV). Experience in developing the detector (including catastrophic failures) shows that when high voltage circuits are potted it is essential to define and control potentials on all surfaces. It is strongly recommended that a dummy unit be potted with pressure and stress gages to determine the forces involved in curing and environmental test cycles. The application of partial discharge testing is essential for assemblies and desirable for past screening (cables, correction techniques at least). Potting should be under vacuum and scrupulous attention must be paid to cleanliness of surfaces to be potted and all containers and equipment used for priming and potting. Author (ESA)

**N86-22620#** Selenia S.p.A., Rome (Italy).
**MEASUREMENT OF THE THERMO-OPTICAL PROPERTIES OF VARYING PAINT THICKNESS ON CARBON FIBER COMPOSITES IN SPACECRAFT STRUCTURES** **c27**
M. Giommi, M. Marchetti (Rome Univ., Italy), G. Salza, and P. Testa (Rome Univ., Italy) *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 233-238 refs Sponsored by Max-Planck Inst. (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

Diffuse spectral reflectivity for solar radiation at normal incidence, spectral normal emissivity, and integrated normal emittance for PV 100 painted samples having different paint thickness and different (carbon fiber or non) substrates were measured. Results mainly for thickness > 70 microns show high spectral reflectivity or low spectral absorption coefficient while spectral emissivity has medium-high values. Limited effect (order of 10%) of the texture and thickness are pointed out.
Author (ESA)

**N86-22621#** Centre National d'Etudes Spatiales, Toulouse (France).
**NEW SPACE PAINTS** **c27**
J. C. Guillaumon *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 239-243 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

White conductive paint with low solar absorptance (improvement of PCB-Z) (0.16 to 0.18); black conductive paint with low outgassing (improvement of PU1); white silicone paint with low solar absorptance (0.13); epoxy primer with low outgassing; and white conductive paint for launchers and aircraft were developed. Improvements under study are outlined. Author (ESA)

**N86-22622#** Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
**LONG TERM TESTS OF CONTAMINATED OPTICAL SOLAR REFLECTORS (OSRS) UNDER COMBINED ENVIRONMENT** **c27**
J. Marco and A. Paillous *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 245-253 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

A simulation program for 5 yr in geosynchronous orbit was carried out on thermal control coatings. Conductive and nonconductive optical solar reflectors (OSR's) were subjected to various thickness (50 to 500A) of contamination deposited in-situ at the start of the test, and irradiated. The variation in solar absorptance at the end of the test is 3 to 4 times greater for the OSR's having received 500 A of the products outgassed from the RTV 566 adhesive. The test data show that contamination is the most likely cause of the excessive degradations observed on many geosynchronous satellites. Author (ESA)

**N86-22623#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Materials Section.
**THE DEGRADATION AND CONTAMINATION EXPERIMENT FLOWN ON THE FIRST EUROPEAN COMMUNICATION SATELLITE ECS-1: PRELIMINARY RESULTS ON CONTAMINATION**
G. Gourmelon and P. Jollet *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 255-258 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

An experiment on ECS-1 to study the in flight behavior of standard cerium doped optical solar reflectors is described. Three quartz crystal microbalances (QCMs) show a small increase of contamination certainly due to very light outgassing products at the beginning of the flight. During the first transfer orbit, a small reevaporation of these products occurred. At the firing of the apogee boost motor there is no detectable contamination on the QCMs. After 780 days in orbit QCM 1 and QCM 3 show the same level of contamination: 1200 ng/sqcm, comparable to the value measured on SCATHA, considered as a clean satellite. On QCM 2 the level is 700 ng/sq cm and lower than QCM 1 and 3. A decrease which appears after 120 days in orbit cannot be explained. Author (ESA)

**N86-22624#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**SCANNING LASER ACOUSTIC MICROSCOPY APPLIED TO THE EVALUATION OF MATERIAL INTERCONNECTIONS** **c36**
B. D. Dunn and D. S. Collins *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 263-269 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The Scanning Laser Acoustic Microscope (SLAM) for the nondestructive inspection of materials and interconnections is introduced. The operational modes of the SLAM are illustrated during the assessment of spacecraft solar cell-to-silver interconnector weldments and electronic component chip solder-attachment to a ceramic carrier. Author (ESA)

**N86-22625#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**PARTICLE FALLOUT PHOTOMETER (PFO)** c35
M. VanEesbeek, R. Berkeljon, and H. Kuiper (URAMEC, Bilthoven, Netherlands) *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 271-274 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

The particle fallout photometer (PFO) for measuring particulate contamination on test surfaces is described. It is based on light scattering by settled particles when subjected to a stabilized light beam nearly parallel to a nonreflective sampling surface. Measuring range is from 0 to 1999 PPM. Particles of 5 microns can be determined. Author (ESA)

**N86-22626#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**ULTRAVIOLET RADIOMETERS** c35
G. Gourmelon, H. Lyall (IRD, Newcastle upon Tyne, England), and R. Froud (IRD, Newcastle upon Tyne, England) *In its* Proceedings of 3rd European Symposium on Spacecraft Materials Space Environment Nov. 1985 p 275-276 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

A radiometer to measure ultraviolet radiation in a series of bands between 180nm and 450nm in a space simulation system was developed. A single channel ultraviolet detector based on the multiband ultraviolet radiometers, but featuring a more robust construction for general use, was also developed. The wavelength coverage is from 250 to 400nm with excellent rejection of visible radiation, and good temperature stability. Detectors with filters to measure a narrow band within the ultraviolet can be supplied. Author (ESA)

**N86-22627#** European Space Agency, Paris (France).
**SPACE ENVIRONMENT SIMULATION TO TEST SATELLITE THERMAL CONTROL COATINGS, VOLUME 1**
M. Dutat, J. Marco, and A. Paillous Aug. 1985 149 p refs Transl. into ENGLISH of 'Essais de Simulation d'Environmentale Spatial sur Revetements de Controle Thermique de Satellites, Tome 1" Rept. CERT-4128-Vol-1 Centre d'Etudes et de Recherche de Toulouse, France Original language document was announced as N85-17012 3 Vol.
(ESA-TT-891-Vol-1; CERT-4128-Vol-1) Avail: NTIS HC A07/MF A01

Simultaneous irradiation of satellite thermal control coatings by electrons, protons, and ultraviolet radiation, simulating 5 yr in geostationary orbit, was carried out. A layer of contaminant, originating from adhesive RTV566 by molecular flux, was applied to samples under controlled conditions. Changes were followed by microbalances and by measurements of optical reflectance over the spectrum. Samples of optical solar reflector (OSR) show a 3 to 4-fold increase in solar absorptance when contaminated by a layer of thickness 0.00005g/sq cm. The test covered four types of OSR: aluminized kapton, ITO-covered FEP, thin aluminized kapton stuck on to thick kapton, white conductive paint PCB Z, and black paint Electrodag 501. The change in solar absorptance of the materials as a function of time in orbit was determined. The electrical conductivity of ITO-covered FEP was observed. Author (ESA)

**N86-22628#** European Space Agency, Paris (France).
**SPACE ENVIRONMENT SIMULATION TO TEST SATELLITE THERMAL CONTROL COATINGS. VOLUME 2, APPENDIX 1: DETAILED RESULTS OF OPTICAL MEASUREMENTS MADE AFTER THE VARIOUS STAGES OF THE FIRST TEST**
Aug. 1985 139 p Transl. into ENGLISH of 'Essais de Simulation d'Environmentale Spatial sur Revetements de Controle Thermique de Satellites. Tome 2, Annexe 1: Resultats Detailles des Mesures Optiques Effectuees apres les Diverses Etapes du Premier Test" Rept. CERT-4128-Vol-2-App-1 Centre d'Etudes et de Recherche de Toulouse, France Original language document was announced as N85-17013 3 Vol.
(ESA-TT-891-Vol-2; CERT-4128-Vol-2-App-1) Avail: NTIS HC A07/MF A01

Simultaneous irradiation of satellite thermal control coatings by electrons, protons, and ultraviolet radiation, simulating 5 yr in geostationary orbit, was carried out. A layer of contaminant, originating from adhesive RTV566 by molecular flux, was applied to samples under controlled conditions. Changes were followed by microbalances and by measurements of optical reflectance over the spectrum. Results for optical measurements before deposition and for 0.2, 0.5, and 1 yr after are presented. Author (ESA)

**N86-22629#** European Space Agency, Paris (France).
**SPACE ENVIRONMENT SIMULATION TO TEST SATELLITE THERMAL CONTROL COATINGS. VOLUME 2: APPENDICES 2, 3, AND 4. APPENDIX 2: DETAILED RESULTS OF OPTICAL MEASUREMENTS MADE AFTER THE VARIOUS STAGES OF THE SECOND TEST. APPENDIX 3: SUMMARY OF OPTICAL RESULTS OBTAINED DURING THE FIRST TEST. APPENDIX 4: SUMMARY OF OPTICAL RESULTS OBTAINED DURING THE SECOND TEST**
Aug. 1985 259 p refs Transl. into ENGLISH of 'Essais de Simulation d'Environentale Spatial sur Revetements de Controle Thermique de Satellites. Tome 2: Annexe 2: Resultats Detailles des Mesures Optiques Effectuees apres les Diverses Etapes du Deuxieme Test. Annexe 3: Recapitulatif des Essais Optiques au Cours du Premier Test. Annexe 4: Recapitulatif des Mesures Optiques Effectuees au Cours du Deuxieme Test" Rept. CERT-4128-Vol-2-App-2-App-3-App-4 Centre d'Etudes et de Recherche de Toulouse, France Original language document was announced as N85-17014 3 Vol.
(ESA-TT-891-Vol-3; CERT-4128-Vol-2-App-2,3,4) Avail: NTIS HC A12/MF A01

Simultaneous irradiation of satellite thermal control coatings by electrons, protons, and ultraviolet radiation, simulating 5 yr in geostationary orbit, was carried out. A layer of contaminant, originating from adhesive RTV566 by molecular flux, was applied to samples under controlled conditions. Changes were followed by microbalances and by measurements of optical reflectance over the spectrum. Results at minus 35 and plus 2 C for up to 5.08 yr after deposition are presented. Author (ESA)

**N86-22630#** Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
**ACCOMMODATION STUDY OF THE CRHESUS CRYOSTAT ON THE EURECA PLATFORM Final Report**
Paris ESA May 1985 109 p refs
(Contract ESTEC-5814/84-NL-B)
(SNIAS-1048ACA/LL/V; ESA-CR(P)-2104) Avail: NTIS HC A06/MF A01

The integration and operational constraints of CRHESUS cryostat as payload on EURECA are defined. The optimum configuration for CRHESUS on EURECA is proposed. The design of the structural support, and a mechanical analysis of the whole CRHESUS plus the structural interface are provided. The data system and the electric power system between CRHESUS and EURECA, and the passive thermal control of payloads are defined. Operational constraints of the system determine ground support equipment. Studies of necessary improvements on the cryostat for compliance as EURECA payload were performed and consequences on the thermal balance and lifetime of cryostat were identified. A development plan, a schedule, and interface requirements for flight of CRHESUS on EURECA are provided. Author (ESA)

**N86-22631#** MATRA Espace, Paris-Velizy (France). Espace Produits et Technologie.
**KEY DESIGN PARAMETERS FOR A VERY LOW GRAVITY IN-ORBIT FACILITY Final Report**
J. C. Amieux, C. Fournier, R. Strittmatter (Dornier-Werke GmbH, Friedrichshafen, West Germany), M. Baier (Dornier-Werke GmbH, Friedrichshafen, West Germany), D. Schmitt (ONERA, Paris, France), and J. Merlet (Intespace) Paris ESA Apr. 1985 372 p refs

(Contract ESTEC-5292/82-NL-PP(SC))
(MATRA-EPT/DT/VT068/098; ESA-CR(P)-2144) Avail: NTIS HC A16/MF A01

Vibration generation and propagation in orbital platforms, including Spacelab and EURECA, were analyzed. Attitude and orbit control subsystem vibration generators; vibrations induced by thermal control subsystems; measurement techniques and experimental aspects for a microgravity environment; vibration induced by microgravity-oriented payloads; and vibration reduction techniques were studied. Dynamic synthesis of a microgravity platform is discussed. Author (ESA)

**N86-22742#** Joint Publications Research Service, Arlington, Va.
**SPECTER OF WAR IN SPACE DISCUSSED, PART 2**
Xianmin Bao *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 1-7 Transl. into ENGLISH from Hangtian (Beijing, China), no. 6, Nov. 1985 p 8-11 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

**N86-22818#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Data Relay Satellite Space Segment.
**THE ESA DATA RELAY SATELLITE PROGRAM**
D. L. Brown, K. G. Lenhart (ESOC, Darmstadt, West Germany), and M. Otter (ESOC, Darmstadt, West Germany) *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 51-56 (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

# 19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

**N86-22833#** Naval Observatory, Washington, D.C.
**MODERN HIGH-PRECISION TIMEKEEPING**
W. J. Klepczynski *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 165-173 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

# 20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

**N86-22632*#** Lockheed Missiles and Space Co., Huntsville, Ala.
**DUCT FLOW NONUNIFORMITIES STUDY FOR SPACE SHUTTLE MAIN ENGINE**
Juergen Thoenes Aug. 1985 129 p refs
(Contract NAS8-34507)
(NASA-CR-178734; NAS 1.26:178734; LMSC-HEC-TR-F042555)
Avail: NTIS HC A07/MF A01 CSCL 21H

To improve the Space Shuttle Main Engine (SSME) design and for future use in the development of generation rocket engines, a combined experimental/analytical study was undertaken with the goals of first, establishing an experimental data base for the flow conditions in the SSME high pressure fuel turbopump (HPFTP) hot gas manifold (HGM) and, second, setting up a computer model of the SSME HGM flow field. Using the test data to verify the computer model it should be possible in the future to computationally scan contemplated advanced design configurations and limit costly testing to the most promising design. The effort of establishing and using the computer model is detailed. The comparison of computational results and experimental data observed clearly demonstrate that computational fluid mechanics (CFD) techniques can be used successfully to predict the gross features of three dimensional fluid flow through configurations as intricate as the SSME turbopump hot gas manifold. Author

**N86-22633*#** Spectra Research Systems, Inc., Huntsville, Ala. Systems Technology Div.
**SPACE SHUTTLE MAIN ENGINE (SSME) LOX TURBOPUMP PUMP-END BEARING ANALYSIS Final Report**
6 Jan. 1986 60 p
(Contract NAS8-36183)
(NASA-CR-178746; NAS 1.26:178746; SRS/STD-TR86-007-535)
Avail: NTIS HC A04/MF A01 CSCL 21H

A simulation of the shaft/bearing system of the Space Shuttle Main Engine Liquid Oxygen turbopump was developed. The simulation model allows the thermal and mechanical characteristics to interact as a realistic simulation of the bearing operating characteristics. The model accounts for single and two phase coolant conditions, and includes the heat generation from bearing friction and fluid stirring. Using the simulation model, parametric analyses were performed on the 45 mm pump-end bearings to investigate the sensitivity of bearing characteristics to contact friction, axial preload, coolant flow rate, coolant inlet temperature and quality, heat transfer coefficients, outer race clearance and misalignment, and the effects of thermally isolating the outer race from the isolator. Author

**N86-22634#** Madrid Univ. (Spain). Dept. of Applied Physics.
**FIELD EMISSION ELECTRIC PROPULSION: FURTHER STUDIES ON COLD CATHODE ELECTRON EMITTERS Final Report**
Fernando Rueda Sanchez, Luis Galan, Lucia Adell, Juan A. Romero, and Raquel Diaz Paris ESA Feb. 1985 41 p
(Contract ESTEC-5052/82-NL-PS(SC))
(ESA-CR(P)-2150) Avail: NTIS HC A03/MF A01

The fabrication method and device properties of cold electron emitters used as ion beam neutralizers in field emission electron propulsion were studied. Overall emission efficiency of 2 mA/watt, imperviousness to atmospheric exposure, low voltage operation, and long term stability over many hundreds of hours were required. Best results are obtained by RF deposition of ITO, formation by heat treatment, deposition of electrical contacts of 90Ni-10Cr alloy by electron bombardment, and slow activation in a high vacuum. Ratios of emission to conduction currents of 10% stable for 1 hr are obtained. Emissions stable over many hundreds of hours are only obtained for lower ratios (1% for ITO and 3% for SnO2). These cold cathodes can be exposed to the atmosphere without further change in their emission characteristics in vacuum. Sets of three cold cathodes in parallel were tested, showing behavior similar to the individual ones in simultaneous operation. Overall efficiency is 0.3Ma/W. Author (ESA)

# 23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

**N86-22635#** Texas Technological Univ., Lubbock. Dept. of Chemistry.
**METAL ION COMPLEXATION BY IONIZABLE CROWN ETHERS**
R. A. Bartsch 10 Sep. 1985 7 p
(Contract DE-AS05-80ER-10604)
(DE86-001946; DOE/ER-10604/T1) Avail: NTIS HC A02/MF A01

Research on the synthesis and characterization of novel ionizable multidentate ligands and their application in competitive solvent extraction of alkali metal cations and alkaline earth cations is discussed. To explore the effect of ring size variation for the lipophilic crown ether salicylic acid derivatives, compounds with very large rings (crown ether = 27-crown-9 and 30-crown-10)

were prepared. Compounds were prepared to probe the influence of the ionized side arm upon cation complexation behavior. The additional series of lipophilic diionizable acyclic polyethers were prepared and investigated as solvent extraction agents for alkaline earth cations. These studies provided important insight into the influence of lipophilic group, ionizable group, and polyether chain length variation upon the efficiency and selectivity of alkaline earth cation extraction by such complexing agents. A series of lipophilic acyclic polyether monocarboxylic acids 8 was also synthesized in which R = H, CH3 and CH2C6H5 and n was varied. Such compounds were found to be suprisingly selective and efficient solvent extraction agents for lithium. DOE

**N86-22636#** California Univ., Berkeley. Lawrence Berkeley Lab.
**STRUCTURE SENSITIVITY OF CATALYTIC REACTIONS**
G. A. Somorjai and J. Carrazza Jul. 1985 41 p refs Presented at the 189th National Meeting of the American Chemical Society, Miami, Fla., 28 Apr. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001981; LBL-19628; CONF-850417-29) Avail: NTIS HC A03/MF A01

The rate and product distribution of chemical reactions catalyzed by metals can depend on the particle size of supported catalysts. This can be explained by the interaction between chemisorbed species and surface sites of different configuration in the metal associated with atoms in terrace, steps and kinks. Single-crystal catalysts are excellent models for studying these interactions. The contribution of single-crystal studies to the understanding of structure sensitivity in catalytic reaction is discussed. Reactions are classified in three types. Structure sensitive reactions, structure insensitive reactions and reactions that show both behaviors, depending on the experimental conditions. Several examples are discussed in each of the three categories. DOE

**N86-22637#** Pacific Northwest Lab., Richland, Wash.
**CATALYTIC GASIFICATION OF BAGASSE FOR THE PRODUCTION OF METHANOL**
E. G. Baker, M. D. Brown, and R. J. Robertus Oct. 1985 101 p refs
(Contract DE-AC06-76RL-01830)
(DE86-002551; PNL-5100) Avail: NTIS HC A06/MF A01

The purpose of the study was to evaluate the technical and economic feasibility of catalytic gasification of bagasse to produce methanol. In previous studies, a catalytic steam gasification process was developed which converted wood to methanol synthesis gas in one step using nickel based catalysts in a fluid-bed gasifier. Tests in a nominal 1 ton/day process development unit (PDU) gasifier with these same catalysts showed bagasse to be a good feedstock for fluid-bed gasifiers, but the catalysts deactivated quite rapidly in the presence of bagasse. Laboratory catalyst screening tests showed K2CO3 doped on the bagasse to be a promising catalyst for converting bagasse to methanol synthesis gas. PDU tests with 10 wt % K2CO3 doped on bagasse showed the technical feasibility of this type of catalyst on a larger scale. A high quality synthesis gas was produced and carbon conversion to gas was high. The gasifier was successfully operated without forming agglomerates of catalyst, ash, and char in the gasifier. There was no loss of activity throughout the runs because catalysts are continually added with the bagasse. Laboratory tests showed about 80% of the potassium carbonate could be recovered and recycled with a simple water wash. An economic evaluation of the process for converting bagasse to methanol showed the required selling price of methanol to be significantly higher than the current market price of methanol. Several factors make this current evaluation using bagasse as a feedstock less favorable: (1) capital costs are higher due to inflation and some extra costs required to use bagasse, (2) smaller plant sizes were considered, so economies of scale are lost, and (3) the market price of methanol in the US has fallen 44% in the last six months. DOE

**N86-22638#** National Bureau of Standards, Gaithersburg, Md. Organic Analytical Research Div.
**DIRECT CALIBRATION OF GC/MS SYSTEMS USING SRM (STANDARD REFERENCE MATERIAL) GAS CYLINDERS Project Report, Jan. 1984 - Aug. 1985**
G. D. Byrd, K. L. Richie, L. T. Sniegoski, and E. White Oct. 1985 32 p Sponsored by Environmental Monitoring Systems Lab., Research Triangle Park, N.C.
(PB86-110715; EPA-600/4-85-082) Avail: NTIS HC A03/MF A01 CSCL 07C

A cryogenic trapping system has been developed for use in calibrating GC/MS systems for the analysis of volatile organic compounds. This system provides for direct Standard Reference Material (SRM) traceability on data generated on gaseous samples. The cryogenic trap is a coil of stainless steel tubing immersed in a cryogen to trap and preconcentrate organic species present in a gaseous sample. The trap also contains a heated injection port for the addition of isotopically labeled compounds for use in isotope dilution measurements. The first part of this research is concerned with the development of IDMS as an independent method for the quantification of analytes in gaseous samples to be used as standards. Results are presented for the determination of bromobenzene in nitrogen at nominal concentrations of 1 and 25 ppb. In the second part of the research, a calibration curve method was developed for using these standards in auditing the performance of GC/MS systems. GRA

# 24 COMPOSITE MATERIALS

Includes laminates.

**N86-22639** Columbia Univ., New York.
**THE ELASTO-PLASTIC BEHAVIOR OF COMPOSITE LAMINATES Ph.D. Thesis**
Lawrence Colin Bank 1985 85 p
Avail: Univ. Microfilms Order No. DA8523113

The elasto-plastic behavior of composite laminated plates or shells is analyzed in terms of the six plate stress resultants (membrane forces and bending moments) and the six plate generalized strains (midplane strains and curvatures). An elasto-plastic constitutive theory that is applied in such a stress-resultant formulation overlooks the matrix and fiber micro-mechanics of the composite material and describes the elasto-plastic response as a function of the properties of the composite laminate as a whole. The stress-resultant constitutive relations are developed for two different plasticity theories; a yield surface plasticity theory and a direct plasticity theory, and are applied to the analysis of both strain-hardening and strain-softening behavior of composite laminates. Both plasticity theories use a two-surface concept in which the inelastic behavior depends upon the distance between a current yield surface and a limit yield surface; each of which consists of piecewise curvilinear sections in the six-dimensional stress-resultant space. Dissert. Abstr.

**N86-22640** California Univ., Los Angeles.
**EDGE EFFECTS IN LAMINATED FIBER COMPOSITE PLATES SUBJECTED TO PLANE LOADING Ph.D. Thesis**
Thomas Anthony Bockrath 1985 134 p
Avail: Univ. Microfilms Order No. DA8525836

A method is described for analyzing the behavior of laminated fiber reinforced composite plates near loaded or unloaded edges. The plates are treated as being composed of separate plies each of which is composed of unidirectional fibers and interfiber connecting material (matrix). Equilibrium is enforced for each ply. For the free edge condition, line forces involving the outward normal are held to zero for all plies when subjected to a temperature change, an axial load, a constant moment type loading, a shear type loading, or combinations thereof. Displacement field equations are expressed in terms of a mean displacement common to all plies and with differential displacement functions unique to each ply. Through the use of these equations, mathematically exact solutions yielding fiber strain, intralaminar shear and interlaminar shear for all plies are obtained for rectangular laminated fiber

reinforced composite plates subjected to various uniform edge loadings, including axial moment type loadings, in plane shear type loadings and thermal loadings. These solutions give the true maximum load carrying capacity of composite plates near edges, which are then used to examine the accuracy of the well known Hill-Tsai criterion for failure in composite structures. Dissert. Abstr.

**N86-22641** Florida Univ., Gainesville.
**MEASUREMENTS OF DAMPING FOR NONDESTRUCTIVELY ASSESSING THE INTEGRITY OF FIBER REINFORCED COMPOSITES Ph.D. Thesis**
Bai-Tang Lee 1985 171 p
Avail: Univ. Microfilms Order No. DA8523856

The development of an experimental method to measure material damping and the assessment of the utility of damping measurements as a tool for quantitatively assessing the integrity of fiber reinforced composites were undertaken. An impulse technique using a noncontact probe displacement motion transducer was developed for the measurement of material damping up to the third mode of vibration. The test specimens, fixed free beams vibrating transversely, were fabricated from five types of composite materials. They were graphite/epoxy, Kevlar/epoxy, and glass/epoxy continuous fiber composites, chopped glass fiber composite, and hybrid composite. The severity of damage simulated by milling machine cuts correlates well with increased damping. There were no significant changes in damping of the specimens having mylar inserts to represent delaminations. For the type of damage from bending tests, no significant changes in damping were observed. An example is given to describe a graphic method to approximately locate and quantify damage. The results of the method give correct ranges in evaluations of the location and severity of the damage by milling machine cuts. Dissert. Abstr.

**N86-22642** Pittsburgh Univ., Pa.
**INTERACTIONS BETWEEN FLOW, HEAT AND MASS TRANSFER DURING FORMATION OF CARBON-FIBER REINFORCED EPOXY COMPOSITES Ph.D. Thesis**
Yen-Seine Wang 1985 174 p
Avail: Univ. Microfilms Order No. DA852482

Reinforced epoxy composites that contain long carbon fibers have shown strength and durability when used in aircraft secondary structures. The curing process of epoxy composites is complex. The polymerization reaction, heat and mass transfer, and flow have to be analyzed simultaneously. The interaction of cure kinetics, chemo-rheology, heat and mass transfer, and flow consolidation is concerned. The pregelation cure kinetics was described in terms of the overall reaction rate parameters and heat of polymerization using differential scanning calorimeter techniques. Viscosity measurements of the epoxy resin as a function of time at constant temperature were made at Lockheed Company and were combined with the kinetic data. The simultaneous heat and mass transfer was modeled mathematically. The density and thermophysical properties of the curing prepreg such as specific heat and thermal diffusivity were measured. Experiments were done with practical composite, simulated composite and also a macroscopic system to study the flow phenomena. Dissert. Abstr.

**N86-22643** Washington Univ., St. Louis, Mo.
**FATIGUE AND ACOUSTIC EMISSION BEHAVIOR OF UNIDIRECTIONAL COMPOSITES Ph.D. Thesis**
Luis Lorenzo 1985 326 p
Avail: Univ. Microfilms Order No. DA85224763

Failure mechanisms in unidirectional composites under static tension and tension-tension fatigue were studied using model composite specimens. Ductile and brittle epoxy resins were combined with polyester- and epoxy-compatible glass fibers and T300 graphite fibers. Matrix cracking was detected very early before fracture of the fibers. The matrix cracks did not grow because of the constrained deformation of the matrix between the fibers. During fatigue, the matrix cracks grew along the fibers in glass specimens while they remained mostly stable in graphite specimens. Failure resulted from the transverse accumulation of fiber failures at a cross section. In the low-cycle region, glass fibers were more fatigue sensitive than graphite fibers. However, in the high-cycle region their fatigue sensitivities were similar. Acoustic emissions (AE) in static tension and fatigue were from fiber failures, matrix cracking and debonding. In glass specimens, matrix cracking and debonding affected wave parameters such as peak amplitude. For a resonant transducer, the recorded peak amplitude, ringdown counts and event duration were, on the average, related to one another. Dissert. Abstr.

**N86-22644** Department of the Air Force, Washington, D.C.
**VOID DETECTION AND COMPOSITION MEASUREMENTS IN COMPOSITE WIRES Patent**
Charles Sve and Eric P. Muntz, inventors (to Air Force) Issued 29 Oct. 1985 8 p Supersedes AD-D010419 (AD-D011972; US-Patent-4,550,255; US-Patent-Appl-SN-511060; US-Patent-Class-250-359.1) Avail: US Patent and Trademark Office CSCL 11/4

This patent provides a novel method and system for the detection of voids or other composition anomalies in wires and particularly in composite wires; which comprises a source of penetrating radiation, such as an X-ray, gamma or neutron source for irradiating the wire; a fluid bath in which the wire may be moved, the bath containing a material having a linear coefficient of attenuation for the radiation closely matching that of a standard or ideal composition wire; and a detector system for observing and comparing the transmission of the radiation through the bath and wire with that through the bath only, or through the bath and wire with that through the bath containing a normal or standard wire. GRA

**N86-22645#** Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
**PREDICTION OF WARPAGE IN COMPONENTS OF COMPOSITE MATERIAL**
F. L. Matthews and J. Sandhu Oct. 1984 186 p refs (Contract MOD(PE)-2037/0257-XR/STR) (BR93823) Avail: Issuing Activity

Warpage deformations in carbon fiber reinforced plastics during fabrication were studied to predict mold shapes. Deformation shapes of thin cross-ply and angle-ply unsymmetrical laminate plates were investigated experimentally and compared with previous results and those predicted by classical laminate theory. An elastic finite element analysis was carried out for the plates in two and three dimensions. A mold with different corner radii was constructed to investigate the warping of channel sections with a variety of lay-ups. An elastic finite element analysis was carried out to predict deformation. In an unsuccessful attempt to improve predictions, an incremental analysis was undertaken. It is concluded that nonlinear coupling effects between stress and temperature-variation of properties should be accounted for. Author (ESA)

**N86-22646#** Royal Aircraft Establishment, Farnborough (England).
**FLEXURAL PROPERTIES OF CARBON FIBRE CLOTH/WOOD VENEER LAMINATES**
J. H. Sewell 17 Apr. 1985 22 p refs (RAE-TM-MAT/STR-1055; BR96647) Avail: NTIS HC A02/MF A01

Flexural tests were made on epoxy and phenolic resin bonded hybrid laminates comprising carbon fiber cloth outer layers on wood veneer cores. Breaking loads and stiffnesses of many of the hybrids exceed those of all carbon fiber cloth laminates of the same weight per unit area of panel. This improvement in flexural properties can be accompanied by a significant decrease in materials costs owing to the replacement of carbon fiber cloth by wood veneers. Significant weight savings may be achieved if carbon fiber laminates are replaced by hybrid laminates having the same flexural breaking strengths or stiffnesses. Author (ESA)

**N86-22647*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**THE EFFECT OF RESIN TOUGHNESS AND MODULUS ON COMPRESSIVE FAILURE MODES OF QUASI-ISOTROPIC GRAPHITE/EPOXY LAMINATES**

Mohsen M. Sohi (Washington Univ., St. Louis, Mo.), H. Thomas Hahn (Washington Univ., St. Louis, Mo.), and Jerry G. Williams Mar. 1986 47 p refs
(NASA-TM-87604; NAS 1.15:87604) Avail: NTIS HC A03/MF A01 CSCL 11D

Compressive failure mechanisms in quasi-isotropic graphite/epoxy laminates were characterized for both unnotched and notched specimens and also following damage by impact. Two types of fibers (Thornel 300 and 700) and four resin systems (Narmco 5208, American Cyanamid BP907, and Union Carbide 4901/MDA and 4901/mPDA) were studied. For all material combinations, failure of unnotched specimens was initiated by kinking of fibers in the 0-degree plies. A major difference was observed, however, in the mode of failure propagation after the 0-degree ply failure. The strength of quasi-isotropic laminates in general increased with increasing resin tensile modulus. The laminates made with Thornel 700 fibers exhibited slightly lower compressive strengths than did the laminates made with Thornel 300 fibers. The notch sensitivity as measured by the hole strength was lowest for the BP907 resin and highest for the 5208 resin. For the materials studied, however, the type of fiber had no effect on the notch sensitivity. Author

**N86-22648#** Construcciones Aeronauticas S.A., Madrid (Spain).
**ADVANCED COMPOSITE STRUCTURES IN COMMERCIAL TRANSPORT AIRCRAFT**
J. Koshorst (Airbus Industrie) Nov. 1984 29 p
(AI/TE3-384/82-Issue-2) Avail: NTIS HC A03/MF A01

Design factors which govern the introduction of advanced composite structures on transport aircraft are reviewed. The efforts made in this field of technology must be balanced either through weight saving, manufacturing considerations, or increased structural performance. The A-310 aircraft is used to demonstrate how these objectives are met. Author (ESA)

**N86-22649#** Fulmer Research Inst. Ltd., Stoke Poges (England).
**GUIDELINES ON BASIC ASPECTS OF JOINTING TECHNOLOGY FOR ADVANCED FIBRE REINFORCED PLASTICS USED IN SPACE STRUCTURES**
D. P. Bashford Paris ESA Sep. 1984 86 p refs
(Contract ESA-5497/83-NL-PB(SC))
(FRI-R878/15A; ESA-CR(P)-2034) Avail: NTIS HC A05/MF A01

Adhesive bonding and mechanical fastening of spacecraft composite-composite and composite-metal structures are reviewed. For most space structures using thin laminates (< 3 mm) adhesive bonding is the preferred means of joining. As section thickness and load carrying requirements increase, bolted or bonded/bolted joints become more applicable. Author (ESA)

**N86-22650#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**PAL: A COMPUTER PROGRAM FOR ASYMMETRIC LAMINATES BUILT UP FROM SEVERAL MATERIALS [PAL - EEN COMPUTERPROGRAMMA VOOR A-SYMMETRISCHE LAMINATEN OPGEBOUWD UIT MEERDERE MATERIALEN]**
P. A. Joosse Aug. 1983 33 p refs In DUTCH
(VTH-M-482) Avail: NTIS HC A03/MF A01

A program for asymmetric laminates consisting of layers with arbitrary thickness, orientation, and (synthetic) materials is described. Laminate behavior under the impact of temperature and humidity is expressed in laminate deformations and tensile stresses per layer. The safety factor of an external load is determined with the crack criterium of Tsai-Wu. Based on the classical laminated plate theory, a plane tensile stress condition in a laminate, which deforms as a whole, was studied. The accuracy of the theory is sufficient for design of wind turbine blades. An asymmetric aramid-carbon laminate was compared with a symmetric laminate, and an asymmetric laminate built up with directed fabrics. Author (ESA)

**N86-22651#** Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
**POTENTIAL OF COMPOSITE MATERIALS TO REPLACE CHROMIUM, COBALT AND MANGANESE IN CRITICAL APPLICATIONS**
J. Clark 1985 160 p refs Sponsored by Office of Technology Assessment, Washington, D.C.
(PB86-123965) Avail: NTIS HC A08/MF A01 CSCL 11D

An analysis of the potential for substituting composite materials for critical materials in the jet engine, automotive and oil/gas equipment industries is given. It includes an assessment of the technical, economic and institutional factors contributing to direct and indirect substitution in these industries. GRA

**N86-22594*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**COMPOSITE MATERIALS FOR SPACE STRUCTURES**
D. R. Tenney, G. F. Sykes, and D. E. Bowles *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environments Nov. 1985 p 9-21 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22612#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**DEVELOPMENT OF STRUCTURAL-COMPOSITE REFLECTOR PANELS FOR A SUBMILLIMETER SPACE TELESCOPE**
R. E. Freeland *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 167-172 refs Sponsored by NASA (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22614#** Societe Nationale Industrielle Aerospatiale, Cannes (France).
**DIMENSIONAL STABILITY OF CARBON-EPOXY COMPOSITE MATERIALS**
V. Baudinaud and L. Massoni *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 179-184 ref (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22615#** Centre National d'Etudes Spatiales, Toulouse (France).
**METAL MATRIX COMPOSITE MATERIALS FOR STRUCTURAL APPLICATIONS**
Ph. Roy and A. Mamode *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 185-190 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22761#** Joint Publications Research Service, Arlington, Va.
**A STUDY OF THE FRACTURE OF CARBON-CARBON COMPOSITES Abstract Only**
Jiaxiang Zhao *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 137 Transl. into ENGLISH from Yuhang Xuebao (Beijing, China), no. 4, 31 Oct. 1985 p 40-48 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

## 25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

**N86-22652** Kentucky Univ., Lexington.
**FLAME SPREADING IN BACKWARD BOUNDARY LAYERS Ph.D. Thesis**
Muthuswamy Vedhanayagam 1985 99 p
Avail: Univ. Microfilms Order No. DA8523937

A theoretical model for the downward spread of a flame in the gas over a semi-infinitely thick fuel bed is presented. Gas phase chemistry is assumed to proceed at an infinite rate while the fuel is taken to pyrolyze at the surface in an Arrhenius fashion. The backward boundary layer character of the flow induced by the flame is exploited, and a transformation that shifts the singularity associated with boundary layer equations to a location, upstream of the leading edge of the flame, where the surface temperature is nearly ambient, is employed. The boundary-layer flow is matched asymptotically for large Grashof number to a potential flow that allows the flow induced by the flame and along the upstream surface of the fuel bed to be calculated. The gas phase formulation is applied to investigate the natural convective flow field associated with a flame spreading downward along a thin cellulosic fuel bed. Temperature and velocity predictions are shown to compare favorably with experimental measurements. Dissert. Abstr.

**N86-22653** Pennsylvania State Univ., University Park.
**PRESSURE-VOLUME-TEMPERATURE-COMPOSITION (PVTX) PROPERTIES OF THE SYSTEM H2O-NaCl AT ELEVATED TEMPERATURES AND PRESSURES Ph.D. Thesis**
Robert John Bodnar 1985 199 p
Avail: Univ. Microfilms Order No. DA8525999

Phase equilibria in the system H2O-NaCl were determined from 550 to 1000 C and from 500 to 1300 bars using synthetic fluid inclusions formed by healing fractures in inclusion free Brazilian quartz in the presence of two coexisting, immiscible H2O-NaCl fluids. Salinities of the two coexisting phases were obtained from micro-thermometric analyses of those inclusions which trapped only a single, homogeneous fluid phase. Results combined with previously published data on the H2O-NaCl system at lower temperatures and pressures, indicate that the two-fluid-phase field extends well into the P-T range of most shallow magmatic-hydrothermal activity. As a consequence, chloride brines exsolved from many epizonal plutons during the process of second-boiling will immediately separate into a high salinity liquid phase and a lower salinity vapor phase and produce coexisting halite bearing and vapor rich fluid inclusions. With increasing salinity, partial molar volumes of NaCl become less negative and approach a constant value close to the molar volume of metastable, supercooled liquid NaCl, indicating saturation of the water structure with NaCl.
Dissert. Abstr.

**N86-22654** British Library Lending Div., Boston Spa (England).
**THE THEORY OF THE DYNAMICS OF THE IMPREGNATION OF POROUS BODIES BY SOLUTIONS**
A. A. Shatov, L. K. Filippov, and O. A. Zhukhovitskii 1985 7 p refs Transl. into ENGLISH from Iz. Vuz Chernaya Metall. (USSR), no. 7, 1985 p 39-41
(BLL-M-36578-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The capillary impregnation of materials, a particular type of brick, by different concentration aqueous solutions of different alcohols was considered. The concentrations of the sorbate close to the meniscus are determined. The dynamics of sorption are analyzed and it is concluded that the concentration close to the meniscus is related to some extent to the initial concentration if there is an inflection on the isotherm. Author

**N86-22655#** Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
**CATALYTIC COMBUSTION IN A TRANSIENT HIGH PRESSURE FACILITY M.S. Thesis**
D. R. J. Baxter Jul. 1985 181 p refs Sponsored by UK Ministry of Defence Procurement Executive
(BR96547) Avail: NTIS HC A09/MF A01

Temperature and composition measurements from experiments on the catalytic combustion of weak mixtures of hydrogen, methane, ethylene and liquid propane, in air initially at pressures up to 60 bar and temperatures up to 820 K are presented and are compared with a simple, theoretical model. The facility was not capable of sustaining catalytic combustion of methane at the test conditions available, but catalytic reactions were obtained using the other fuels tested. Premixed and injected fuels were studied, with the quantitative work concentrating on ethylene injection into air flows to give fully mixed equivalence ratios of 0.1 to 0.2. Results show that the transient facility produces high temperature and pressure air flows sufficiently steady to sustain surface oxidation processes. It is also possible to obtain relevant measurements of temperature and gas composition within the run period of 1 sec.
Author (ESA)

**N86-22656#** Materials Quality Assurance Directorate, London (England).
**A SCREENING TECHNIQUE FOR THE PRESENCE OF LEAD IN PAINT BY ATOMIC ABSORPTION SPECTROPHOTOMETRY**
G. F. B. Hamilton and A. E. Morris Mar. 1984 10 p refs
(MQAD-TP-871; BR96573) Avail: NTIS HC A02/MF A01

A rapid, semiquantitative method for the determination of lead in decorative paints to identify samples which warrant a full quantitative lead determination is described. The procedure involves introducing the paint on hardened filter paper into the atomic absorption spectrophotometer flame without any prior sample preparation. The technique can be used with plastics, papers, and other materials and elements suitable for atomic absorption spectrophotometry. Author (ESA)

**N86-22657#** Defence Research Information Centre, Orpington (England).
**SPECIFIC CHARACTER AND LIMITS OF SOME TECHNIQUES USED FOR THE ANALYSIS OF THIN FILMS**
J. C. Pivin Jul. 1985 28 p refs Transl. into ENGLISH from Journal de Microscopie et de Spectroscopie Electroniques, vol. 9, no. 2, 1984 p 75-94
(DRIC-T-7534; BR97251) Avail: NTIS HC A03/MF A01

Spectroscopic techniques for the analysis of composition, electronic structure, short range order, and microstructure of thin films are reviewed. Electron spectrometry; absorption spectrometry; emission spectrometry with ion bombardment; and X-ray diffraction, diffusion, and resonance absorption are considered. Author (ESA)

**N86-22658#** Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
**LASER DOPPLER VELOCIMETRY INVESTIGATION OF THE TURBULENCE STRUCTURE OF AXISYMMETRIC DIFFUSION FLAMES**
J. P. Sislian, L.-Y. Jiang, and R. A. Cusworth Feb. 1986 132 p refs
(UTIAS-291; ISSN-0082-5255) Avail: NTIS HC A07/MF A01

The influence of the combustion process on the turbulence structure of the combustible jet flow is considered, and data is provided against which results of numerical prediction methods for such flows embodying various turbulence and combustion models can be compared, with a view to improving the understanding of relevant transport processes and on guiding modelling and prediction efforts of such flows. A one dimensional laser velocimeter operating in forward scatter differential Doppler mode was used to obtain the measurements. Gas temperatures were measured by thermocouples. A visual study by schlieren photography was also conducted. It is found that the existence of the flame suppresses turbulence in the upstream region of the jet flow and enhances it in the downstream region, where turbulence intensities are substantially higher than in the corresponding cold jet flow. The combustion process was found to have also a marked influence on the turbulence macroscale. It is significantly smaller than in the cold jet flow in the upstream region and increases appreciably at downstream distances, the rate of this increase closely following the rate of temperature increase. Author

**N86-22659#** Battelle Columbus Labs., Ohio.
**LASER PHOTOCHEMICAL PRODUCTION OF GERMANIUM AND DOPED-GERMANIUM FILMS**
A. E. Stanley, R. A. Johnson, A. H. Roberts, and J. B. Turner Sep. 1985 42 p
(Contract DAAG29-81-D-0100)
(AD-A162576; AD-E950772) Avail: NTIS HC A03/MF A01 CSCL

07/5

Germanium and doped-germanium polycrystalline films have been formed using CO2 laser photochemistry. The compounds which were found to be the best candidates for the production of germanium were germane, ethylgermane and diethylgermane. The gas phase reactions were monitored using fourier transform infrared spectroscopy, also used for identification of end products. Scanning electron microscopy was used for analysis of the films. The products identified on irradiation of germane were germanium and hydrogen. Conversion rates on the order of 86% were observed, indicating possible cost savings over thermal processes. On irradiation, both diethylgermane and ethylgermane produce ethylene, germane, germanium and hydrogen. Germanium containing cadmium and aluminum was successfully produced by the irradiation of germane mixtures containing dimethylcadmium or trimethylaluminum respectively. Author (GRA)

**N86-22660#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
**MECHANISM OF PLUTONIUM METAL DISSOLUTION IN HNO3-HF-N2H4 SOLUTION**
D. G. Karraker 1985 11 p refs Presented at ACTINIDES 85, Aix-en-Provence, France, 1 Sep. 1985
(Contract DE-AC09-76SR-00001)
(DE86-001975; DP-MS-85-45; CONF-8509147-10) Avail: NTIS HC A02/MF A01

An oxidation-reduction balance of the products of the dissolution of plutonium metal and alloys in HNO3-HF-N2H4 solution shows that the major reactions during dissolution are the reduction of nitrate to NH3, N2 and N2O by the metal, and the oxidation of H free radicals to NH3 by N2H4. Reactions between HNO3 and N2H4 produce varying amounts of HN3. The reaction rate is greater for delta-Pu than alpha-Pu, and is increased by higher concentrations of HF and HNO3. The low yield of reduced nitrogen species indicates that nitrate is reduced on the metal surface without producing a significant concentration of species that react with N2H4. It is conjectured that intermediate Pu valences and electron transfer within the metal are involved. DOE

**N86-22661#** California Univ., Berkeley. Lawrence Berkeley Lab.
**INTERACTION OF CO MOLECULES WITH EVAPORATED SILVER, GOLD, AND COPPER FILMS: AN INFRARED SPECTROSCOPIC INVESTIGATION USING A THERMAL DETECTION TECHNIQUE**
P. Dumas, R. G. Tobin, and P. L. Richards Sep. 1985 9 p Presented at the 6th Vibrations At Surfaces Conference, Bowness-on-Windermere, England, 15 Sep. 1985 Prepared in cooperation with Centre National de la Recherche Scientifique, 94 - Thiais (France)
(Contract DE-AC03-76SF-00098)
(DE86-001987; LBL-19465; CONF-8509183-1) Avail: NTIS HC A02/MF A01

Infrared absorption spectroscopy is used to study the adsorption of CO at low temperatures on evaporated films of silver, gold, and copper as a function of the coverage of CO and the deposition temperature of the metal. For all three metals two distinct adsorption regimes are observed when the cold metal is exposed to CO gas. These regimes arise depending on whether the deposition temperature of the metal (or the highest temperature at which the metal has been annealed) is above or below a threshold temperature. For all three metals, the shift of the vibrational frequency with CO coverage has been analyzed, and the static and dynamic contributions separated. An analysis of infrared intensities and vibrational polarizabilities shows no evidence for any special infrared enhancement analogous to the large enhancement in Raman cross section peculiar to adsorption on rough noble metal films deposited at low temperatures. DOE

**N86-22662#** Utah Univ., Salt Lake City. Earth Sciences Lab.
**PREFERRED METHODS OF ANALYSIS FOR CHEMICAL TRACERS IN MODERATE- AND HIGH-TEMPERATURE GEOTHERMAL ENVIRONMENTS**
R. L. Kroneman, K. R. Yorgason, and J. N. Moore Dec. 1984 47 p refs
(Contract DE-AC07-79ID-12079)
(DE86-002008; DOE/ID-12079/128; ESL-84001-TR) Avail: NTIS HC A03/MF A01

This report describes the sampling and analytical techniques used for tracer analysis in the Raft River and East Mesa field tests. The collection procedures and sample preservation techniques, analytical methods and possible sources of contamination or error are discussed in detail. DOE

**N86-22663#** Notre Dame Univ., Ind.
**[ACTIVITIES OF THE RADIATION LABORATORY, UNIVERSITY OF NOTRE DAME] Quarterly Report, 1 Jul. - 30 Sep. 1985**
Oct. 1985 55 p
(Contract DE-AC02-76ER-00038)
(DE86-002458; DOE/ER-00038/2773; NDRL-2773) Avail: NTIS HC A04/MF A01

Seventy eight abstracts are presented in the fields of radiation chemistry and photochemistry. In addition, publication, external talks and presentations are listed. DOE

**N86-22664#** Los Alamos National Lab., N. Mex.
**ELECTRONIC STRUCTURE AND REACTIONS OF TRANSITION METAL COMPLEXES USING EFFECTIVE CORE POTENTIALS**
P. J. Hay and C. M. Rohlfing 1985 13 p refs Presented at the NATO Conference on Quantum Chemistry: The Challenge of Transition Metals and Coordination Chemistry, Strasbourg, France, 16 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000821; LA-UR-85-3322; CONF-8509184-1) Avail: NTIS HC A02/MF A01

Effective core potentials are employed to study the geometries and binding of the species MCO and M(CO)4 for M=Ni, Pd and Pt, and addition reactions of H2 to W(d(6)) and Pt(d(10)) centers. Moller-Plesset perturbation theory is assessed as a means of incorporating electron correlation effects in transition metal species. DOE

**N86-22665#** Oak Ridge National Lab., Tenn.
**MULTI-COLUMN STEP-GRADIENT CHROMATOGRAPHY SYSTEM FOR AUTOMATED ION EXCHANGE SEPARATIONS**
T. L. Rucker 1985 7 p Presented at the 28th Oak Ridge National Laboratory Conference on Analytical Chemistry, Knoxville, Tenn., 1 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002174; CONF-8510151-11) Avail: NTIS HC A02/MF A01

A multi-column step-gradient chromatography system has been designed to perform automated sequential separations of radionuclides by ion exchange chromatography. The system consists of a digital programmer with automatic stream selection valve, two peristaltic pumps, ten columns, and a fraction collector. The automation allows complicated separations of radionuclides to be made with minimal analyst attention and allows for increased productivity and reduced cost of analyses. Results are reported for test separations on mixtures of radionuclides by the system. DOE

**N86-22666#** Mound Lab., Miamisburg, Ohio.
**MOUND ACTIVITIES IN CHEMICAL AND PHYSICAL RESEARCH, JANUARY - JUNE 1985**
25 Oct. 1985 25 p
(Contract DE-AC04-76DP-00053)
(DE86-002541; MLM-3305) Avail: NTIS HC A02/MF A01

Additional experiments were run with carbon disulfide in order to further explore the relationship between the isotopic thermal diffusion factor and differences in molecular masses and moments. Experiments with materials at three levels of (34)S enrichment were used to get thermal diffusion factors for four binary molecular pairs, three involving sulfur substitution and one involving carbon substitution. An equation of the same form as that used for substituted benzenes was found to reproduce the data quite closely. The term involving the mass difference was nearly the same as

that for the benzenes. The effect of the second moment, however, was much larger for carbon disulfide. A liquid phase thermal diffusion column with a hot-to-cold wall spacing of 406 (MU)m was assembled and tested for calcium isotope separation. The experiment, which was done with a 36 wt % aqueous calcium nitrate solution, yielded a separation equivalent to a value of 0.150 for the logarithm of the (48)Ca/(40)Ca separation factor. The result is consistent with the value of 0.136 predicted on the basis of earlier experiments with a column having a nominal spacing of 305 (MU)m. Work on calcium isotope enrichment by ion exchange chromatography with a macrocyclic compound was completed. Calcium-crown complexes were found to be present in both fluid and solid phases of the chromatography column. Thermal diffusion factors for equimolar mixtures of neon and argon with carbon dioxide have been measured in the temperature range from 250 to 700 K. The data were obtained in a 20-tube trennschaukel or swing separator.DOE

**N86-22667#** M L Energia, Inc., Princeton, N.J.
**ENHANCEMENT OF PREMIXED H2/AIR FLAMES WITH PHOTOCHEMICALLY PRODUCED RADICALS: ANALYTICAL MODELING**
M. Lavid, J. G. Stevens, and C. K. Westbrook Oct. 1985 6 p refs Presented at the Fall Technical Meeting of the Eastern Section of the Combustion Institute: Chemical and Physical Processes in Combustion, Philadelphia, Pa., 4 Nov. 1985 Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE86-002602; UCRL-93473; CONF-851133-1) Avail: NTIS HC A02/MF A01

Many combustion applications are presently limited by constraints associated with the combustion process itself, such as flammability, flame propagation, ignition and stability. As part of an Air Force sponsored program, initiation and enhancement of combustion by irradiation of unsensitized fuel-oxidizer mixtures is being investigated at M.L. ENERGIA, Inc. In this paper we report on our continuing analytical findings of radiative enhancement in hydrogen-air mixtures at atmospheric pressure. DOE

**N86-22668#** New York Univ., New York. Dept. of Chemistry.
**PHYSICO-CHEMICAL METHODS FOR THE STUDY OF POLYCYCLIC AROMATIC HYDROCARBON - DNA INTERACTIONS**
N. E. Geacintov 28 Oct. 1985 12 p refs
(Contract DE-AC02-78EV-04959)
(DE86-002970; DOE/EV-04959/7) Avail: NTIS HC A02/MF A01

By studying the reaction rate, intercalative noncovalent binding, and covalent binding of benzo(a)pyrene-7,8-diol-9,10-oxide to different synthetic polynucleotides, a deeper understanding of the reaction mechanisms of aromatic diol epoxide carcinogens with DNA has been obtained. Studies on the structures of the covalent adducts provide a good model for the mechanisms of interaction of these carcinogenic and tumorigenic molecules with DNA. DOE

**N86-22669#** Denver Univ., Colo.
**PHOTODEGRADATION INHIBITORS FOR POLYACRYLONITRILE/Ag (PAN/Ag) FILMS Annual Report**
C. A. Sergides, A. R. Chughtai, and D. M. Smith Sep. 1985 79 p
(Contract DE-AC02-83CH-10093)
(DE85-016864; SERI/STR-255-2723) Avail: NTIS HC A05/MF A01

Three types of UV stabilizers have been investigated for the photostabilization of PAN/Ag films. First, the effect of UV-absorber stabilizers, like the hydrohybenzophenone derivatives (UVINUL SERIES, BASF) absorbing UV radiation in the same region as PAN, was studied. Such additives generally had little effect, while in some cases, photodegradation of PAN was enhanced because of photosensitization. Second, the effect of quencher stabilizers like nickel chelate complexes (Irgastab 2002, CIBA-GEIGY) on the photodegradation of PAN/Ag films was examined. They resulted in marked decreases in the photodegradation of the polymer. Thirdly, antioxidant stabilizers, such as 2,6-di-tert-butyl-4-methylphenol derivatives (Irganox 1010, CIBA-GEIGY), were studied and also found to have a significant inhibiting effect on the photodegradation of PAN. Increasing the concentration of an effective stabilizer was observed to further decrease the photodegradation. The stabilizer concentration was kept generally low, and a combination of 1% wt antioxidant (Irganox 1010) and 0.5% wt quencher (Irgastab 2002) proved to be optimum. Irganox 1010 and Irgastab 2002 in separate preliminary experiments (in the absence of the polymer) were found to be stable to ultraviolet radiation of air mass one (WG 305). DOE

**N86-22670#** National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
**TRAPPED IONS AND LASER COOLING: SELECTED PUBLICATIONS OF THE ION STORAGE GROUP OF THE TIME AND FREQUENCY DIVISION, NBS, BOULDER, COLORADO**
D. J. Wineland, W. M. Itano, J. C. Bergquist, and J. J. Bollinger Jul. 1985 195 p refs Sponsored by ONR and AFOSR
(PB86-110855; NBS-TN-1086) Avail: NTIS HC A09/MF A01; also available from SOD HC as 003-003-02666-2 CSCL 07D

The report contains selected publications of the Ion Storage Group of the Time and Frequency Division, NBS, Boulder, Colorado. Partial contents include: Laser Cooling of Atoms; Spectroscopy of a Single Mg(+) Ion; Laser Cooling of Ions Stored in Harmonic and Penning Traps; Spectroscopy of Stored Ions; Frequency Standard Research Using Stored Ions; Laser-Cooled-Atomic Frequency Standard. GRA

**N86-22671#** Romicon, Inc., Woburn, Mass.
**DEVELOPMENT OF A LOW PRESSURE HOLLOW FIBER REVERSE OSMOSIS MEMBRANE UTILIZING INTERNAL FLOW FOR USE ON A LOW SALINITY WATER Final Report**
J. G. Vouros and A. J. Testa 1985 131 p Sponsored in part by Geological Survey, Reston, Va.
(Contract DI-14-34-0001-0445)
Avail: NTIS HC A07/MF A01 CSCL 07A

An acrylic membrane prepared by crosslinking hydroxyethyl methacrylate-methacrylic acid copolymer on a flat sheet microporous support exhibited excellent chlorine resistance, 95% sodium chloride rejection and 20 gal/sq ft -day flux at 250 psi pressure. Polysulfone hollow fibers utilizing internal flow with inside diameters of 1.1 mm have been developed as composite membrane supports to operate continuously at 250 psi pressure. The acrylic thin film composite membrane was deposited on the inside surface of these polysulfone fiber supports and produced a composite membrane that yielded excellent chlorine stability, 70% sodium chloride rejection and 20 gal/sq ft. - day flux at 250 psi operating pressure. This membrane also exhibited cleanability via Romicon's conventional permeate backflushing and reverse flow techniques without experiencing performance degradation.
Author (GRA)

**N86-22672#** Bureau of Mines, Amarillo, Tex. Helium Field Operations.
**COMPUTER PROGRAM FOR CALCULATING GRAVIMETRIC PRIMARY STANDARD GAS MISTURES**
E. W. Loya 1985 46 p refs
(PB86-127370; BM-IC-9031; LC-85-600064) Avail: NTIS HC A03/MF A01 CSCL 07D

The Bureau of Mines has developed a computer program for calculating the composition of gravimetric primary standard gas mixtures. The FORTRAN IV program applies corrections due to buoyancy variations of the cylinder and inaccuracies of the balance weights. The program also determines the statistical error due to the sensitivity and precision of the balance and applies the analytical error of the weighted gases. Author (GRA)

**N86-22673#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: CHEMISTRY**
5 Feb. 1986 68 p Transl. into ENGLISH from various Russian articles
(JPRS-UCH-86-002) Avail: NTIS HC A04/MF A01

Progress in research and development in chemistry and chemical engineering is reported. The following topics are discussed: adsorption, analytical chemistry, biochemistry, catalysis, chemical industry, coal gasification, explosives and explosions, fertilizers, food technology, inorganic compounds, ion exchange, nitrogen compounds, organometallic compounds, petroleum processing technology, polymers and polymerization, radiation chemistry, rubber and elastomers, and wood chemistry. For individual titles, see N86-22674 through N86-22678.

**N86-22674#** Joint Publications Research Service, Arlington, Va.
**STUDY OF METHAN ADSORPTION ON ETA-Al2O3 BY IR-SPECTROSCOPIC METHOD IN DIFFUSE-SCATTERED LIGHT Abstract Only**
I. S. Muzyka, S. A. Zubkov, V. Yu. Borovkov, and V. B. Kazanskiy *In its* USSR Report: Chemistry (JPRS-UCH-86-002) 5 Feb. 1986 p 1 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 284, no. 2, 1985 p 391-394 (For primary document see N86-22673 13-25)
Avail: NTIS HC A04/MF A01

Reaction of methane (deuteromethane) with the surface of eta-Al2O3 catalyst was studied by IR spectroscopy in diffusely scattered light. Molecular adsorption centers of methane (deuteromethane) and centers of its dissociative adsorption were noted on the surface of the treated eta-Al2O3. Reacting with CO2 molecules, the OH and OD groups converted to surface bicarbonates which are inactive in the H-D exchange with hydrogen and methane. It was shown that varous centers of molecular and dissociative adsorption of methane exist on dehydroxylated surface of Al2O3. The acid-base pairs Al+O- appear to be the centers of molecular adsorption on which the polarization of CH bonds of the adsorbed CH4 molecules takes place. E.A.K.

**N86-22675#** Joint Publications Research Service, Arlington, Va.
**ULTRASOUND-BASED METHOD FOR STUDIES ON COMPRESSION MOLDING KINETICS OF PLASTICS Abstract Only c27**
E. A. Tagiyev, Ye. B. Raskin, and M. S. Trizno *In its* USSR Report: Chemistry (JPRS-UCH-86-002) 5 Feb. 1986 p 4 Transl. into ENGLISH from Plasticheskiye Massy (Moscow, USSR), no. 6, 1985 p 60-61 (For primary document see N86-22673 13-25)
Avail: NTIS HC A04/MF A01

Technical details are presented on an ultrasound method to measure the kinetics of compression molding of plastics is presented. The design consists of a standard chamber with a plunger that functions simultaneously as a waveguide. Compression is achieved with a magnetostriction transformer, with a potential difference created by leads imbedded in the plunger and the bottom of the chamber. Changes in the current passing through the plastic material is recorded on an oscillograph. The method allows for continuous monitoring of solidification through the introduction of ultrasonic waves into the compresion zone. E.A.K.

**N86-22676#** Joint Publications Research Service, Arlington, Va.
**APPLICATION OF CHN-2 ANALYZER IN DETERMINATION OF ELEMENTAL COMPOSITION OF ORGANIC POLYMERS Abstract Only c27**
Z. N. Zigel, V. M. Ryabikova, O. G. Utkina, and I. T. Korzhova *In its* USSR Report: Chemistry (JPRS-UCH-86-002) 5 Feb. 1986 p 4-5 Transl. into ENGLISH from Plasticheskiye Massy (Moscow, USSR), no. 6, 1985 p 43-45 (For primary document see N86-22673 13-25)
Avail: NTIS HC A04/MF A01

Statistical analysis was conducted on the results of elemental analysis of certain simple and polymeric organic substances, using the CHN-2 analyzer for combustion analysis. Data are presented on the analysis of acetanilide, cystine, phenacetin, polyvinyl chloride, polystyrene, polyethylene, and styrene-acrylonitrile copolymer, giving the arithmetic mean, root mean square error, and precision at 95% reliability limit. The poor reproducibility of the determinations of carbon, hydrogen and nitrogen in the case of the polymers is ascribed to heterogeneous combustion conditions of intermediate, heat stable, low MW compounds. The decomposition of some polymers, is a highly endothermic depolymerization process that in itself limits the degree of combustion of the sample. E.A.K.

**N86-22677#** Joint Publications Research Service, Arlington, Va.
**MANY FACES OF CATALYST**
N. Ilinskaya *In its* USSR Report: Chemistry (JPRS-UCH-86-002) 5 Feb. 1986 p 9 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 11 Oct. 1985 p 2 (For primary document see N86-22673 13-25)
Avail: NTIS HC A04/MF A01

The mechanism of catalysis, was studied. It was found that catalysis depends on the concentration of additives and the temperature at which the process takes place. Under certain conditions, an accelerator-additive can act as a catalytic poison. An inhibitor is capable of making a reaction more active. A general theory was formulated which explains this ambiguity. The mechanism by which additives affect the activity of catalysts is explained, and a basis is provided for heightening the selective action of chemical processes. The synthesizing of highly effective catalysts and the development of processes for their production are practical applications of the discovery. E.A.K.

**N86-22678#** Joint Publications Research Service, Arlington, Va.
**STEADY COMBUSTION OF INITIATING EXPLOSIVES AT HIGH PRESSURE Abstract Only**
A. Ye. Fogelzang, V. Yu. Yegorshev, A. Yu. Pimenov, V. P. Sinditskiy, A. R. Saklantiy, and B. S. Sverlov *In its* USSR Report: Chemistry (JPRS-UCH-86-002) 5 Feb. 1986 p 19 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 282, no. 6, 1985 p 1449-1452 (For primary document see N86-22673 13-25)
Avail: NTIS HC A04/MF A01

The first successful steady combustion of selected initiating explosives was obtained at pressures ranging from 0.1 to 40 MPa, employing a technique designed to yield a pore-free substance to avoid or preclude factors that may lead to convective situations and, thereby, to explosive events. Data are presented on the density, pressure range, rate of combustion, and calculated combustion temperature at 10 MPa for diazodinitrophenol, tricycloacetoneperoxide, hexamethyleneperoxidediamine, tetrazene, and cyanurtriazide. Any initiating explosive can be studied in this manner, with the possible exception of lead azide type-initiating explosives. E.A.K.

# 26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

**N86-22679** Iowa State Univ. of Science and Technology, Ames.
**A CRACK CLOSURE STUDY ON 2024 T315 ALUMINUM ALLOY BY THE MOIRE METHOD Ph.D. Thesis**
Chwei-Goong Tseng 1985 99 p
Avail: Univ. Microfilms Order No. DA8524704

The validity of measuring crack opening displacements by using the high sensitivity Moire interferometry technique was evaluated. The stress intensity factor determination using the crack opening displacements was studied. The data on the crack opening displacement were used to obtain the crack tip opening load of a fatigue crack in an 2024 T351 aluminum alloy compact tension specimen. Near-tip and back-face strain gauges as well as a clip on gauge were employed to record the displacement load curves used to determine the crack-tip-opening load. The results of the crack opening load, as determined from these measurements could be separated into two groups: one was the near-tip locally influenced opening load, the other was the crack face globally influenced opening load. A discussion was given concerning the significance of these results. A residual stress intensity factor was proposed for the fatigue crack specimen. Dissert. Abstr.

**N86-22680** Case Western Reserve Univ., Cleveland, Ohio.
**STRESS CORROSION CRACKING AND HYDROGEN EMBRIT-**

**TLEMENT OF FERRITIC STAINLESS STEELS EFFECTS OF THERMOMECHANICAL TREATMENTS Ph.D. Thesis**
Rajan Narayana Iyer 1985 162 p
Avail: Univ. Microfilms Order No. DA8525227

The influence of thermomechanical treatments on the stress corrosion crack initiation and hydrogen assisted crack growth of 26Cr-1Mo alloys in boiling 42% LiCl solutions and 5%H2SO4 solutions was investigated using a uniaxial constant load fixture. Annealing at temperatures where only recovery processes operate, reduces the susceptibility of prestrained low interstitial 26Cr-1Mo alloy (E-Brite) to SCC in boiling chloride solutions. Both slip step height and density, which are the major parameters controlling the breakdown of protective films in these alloys, are reduced substantially by annealing near 300 C for 1 hour. Continuous exposure of unfilmed metal to the aggressive environment is provided during SCC due to creep; this causes reduction in overall repassivation rate. Grain coarsening and prestraining operations result in larger slip step height and density due to increase in dislocation density. Dissert. Abstr.

**N86-22681** Pittsburgh Univ., Pa.
**THE INTERACTIONS BETWEEN EROSION AND OXIDATION OF METALS AT ELEVATED TEMPERATURES Ph.D. Thesis**
Chih-Tsung Kang 1985 240 p
Avail: Univ. Microfilms Order No. DA8524837

An apparatus to provide well defined and controlled erosion-oxidation conditions, such as particle loading, velocity, temperature and angle of attack, was designed, constructed and tested. Samples of pure nickel, cobalt and nickel oxide were exposed to a variety of temperatures, velocities and atmospheres. The degradation rate of a sample was monitored by measuring the weight change of the sample and it is shown how such data are related to metal degradation. The surfaces and cross sections of the exposed specimens were examined using optical metallography, scanning electron microscopy with EDS analysis and X-ray diffraction techniques, in order to obtain detailed information about the processes by which materials is removed. It was found that the combined effects of erosion and oxidation are always more severe than either process alone. Three types of interactions between oxidation and erosion were identified. These interactions are discussed and degradation models are developed. By using a computer simulation technique, it was possible to demonstrate that certain commonly observed features are a result of plastic deformation alone and do not require materials removal for their formation Dissert. Abstr.

**N86-22682** British Library Lending Div., Boston Spa (England).
**MIGRATION OF CARBON IN NICKEL BY DIFFUSION DURING HIGH PRESSURE PULSES**
S. V. Zemskii, A. R. Kutsar, E. A. Ryabchikov, and I. Z. Drogoveiko 1985 9 p refs Transl. into ENGLISH from Iz. Vuz Chernaya Metallurgiya (USSR), no. 7, 1985 p 112-116
(BLL-M-36586-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The movement of carbon between two sheets, one containing a carbon isotope and the other not containing it, when high pressures are applied is discussed. Figures are given for the depth to which carbon penetrates into the unmarked sheet. These figures are related to the temperature and pressure. This penetration exceeds the degree to which carbon enters steel under equivalent conditions. The possible mechanisms for this phenomenon are considered. Author

**N86-22683#** Defence Research Information Centre, Orpington (England).
**SHAPE AND DEPTH OF THE CRYSTALLIZATION FRONT IN STEEL INGOTS REMELTED BY THE ELECTROSLAG METHOD DETERMINED WITH THE AID OF RADIOACTIVE PHOSPHORUS**
E. Georgescu and A. Benescu Sep. 1985 16 p refs Transl. into ENGLISH from Metalurgia, vol. 35, no. 7, 1983 p 308-312
(DRIC-T-7561; BR97250) Avail: NTIS HC A02/MF A01

Labeling of metallic baths with Cu32p is described. Combined with the autoradiographic method, it is possible to obtain a visual record on special film (on a 1: 1 scale), the shape and dimensions of the solidification front, as well as the direction of growth of the crystals and their dimensions, as a function of the metal remelting and cooling parameters, and hence to study the crystallization mechanism and the types of defects appearing during the solidification process and their causes. The method is also interesting for investigations of a direct applicative nature or for basic research in the field of the solidification of metals and alloys, offering the possibility of directing and controling solidification processes. Author (ESA)

**N86-22684#** Defence Research Information Centre, Orpington (England).
**PREVENTION OF THERMAL FATIGUE IN Cu-BASED SHAPE MEMORY ALLOYS**
Y. Ikai and K. Murakami Aug. 1985 8 p refs Transl. into ENGLISH from Kogyo Zairyo, vol. 31, 1984 p 56-57
(DRIC-T-7589; BR97013) Avail: NTIS HC A02/MF A01

The improvement of mechanical properties (elongation to rupture, and mechanical strengths) of copper based shape memory alloys is discussed. The low mechanical properties of copper-based alloys are derived from their coarse grain size, so attempts were made to refine the grain size of the copper alloys by adding 4th and 5th alloying elements. The samples which were successful in grain refining the alloys show a great reduction in time-dependent deterioration of shape memory function and thermal fatigue properties. No solution for time-dependent deterioration is detected. Author (ESA)

**N86-22685*#** Auburn Univ., Ala.
**ON THE DETERMINATION OF THE ORIGIN OF LINEAR ANOMALY IN THE MACROSTRUCTURE OF VPPA WELDED 2219-T87 ALUMINUM ALLOY: PRELIMINARY REPORT**
W. A. Jemian Feb. 1986 29 p refs
(Grant NGT-01-008-021)
(NASA-CR-178745; NAS 1.26:178745) Avail: NTIS HC A03/MF A01 CSCL 11F

The cause and significance of the weld radiograph enigma, which is a linear anomaly in the features of the X-ray film is examined. By observing features on available radiographs and in studying published reports of similar features, it was possible to conclude that there are many manifestations of the enigma, and that they are all specific features of fine structure in radiographs due to natural processes connected with welding and to specific X-ray absorption and diffraction phenomena. These processes include the thermal distribution and liquid metal flow in welding, the development of microstructure, morphology, second phase particles and porosity due to the solidification process, and to the pattern of residual stresses after the weld metal has cooled to the ambient temperature. Microdensitometer traces were made across weld radiographs of standard enigmatic types. Similar patterns were produced by computer simulation. These show that the enigma is a relatively low contrast feature compared to real weld defects, such as undercuts or centerline cracks. The enigma can be distinguished from weld defects by these microdensitometer traces. The enigma effect on weld properties is not known but is expected to be minor. Author

**N86-22686*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**INFLUENCE OF FATIGUE CRACK WAKE LENGTH AND STATE OF STRESS ON CRACK CLOSURE**
Jack Telesman and Douglas M. Fisher 1986 27 p refs Presented at the International Symposium on Fatigue Crack Closure, 1-2 May 1986; sponsored by the American Society for Testing and Materials
(NASA-TM-87292; E-2999; NAS 1.15:87292) Avail: NTIS HC A03/MF A01 CSCL 11F

The location of crack closure with respect to crack wake and specimen thickness under different loading conditions was determined. The rate of increase of K sub CL in the crack wake was found to be significantly higher for plasticity induced closure

in comparison to roughness induced closure. Roughness induced closure was uniform throughout the thickness of the specimen while plasticity induced closure levels were 50 percent higher in the near surface region than in the midthickness. The influence of state of stress on low-high load interaction effects was also examined. Load interaction effects differed depending upon the state of stress and were explained in terms of delta K sub eff.
Author

**N86-22687*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**CERAMIC THERMAL BARRIER COATINGS FOR ELECTRIC UTILITY GAS TURBINE ENGINES**
Robert A. Miller 1986 15 p refs Presented at the 3rd Berkeley Conference on Corrosion, Erosion, and Wear of Materials, Berkeley, Calif., 29-31 Jan. 1986; sponsored by the National Association of Corrosion Engineers
(NASA-TM-87288; E-2994; NAS 1.15:87288) Avail: NTIS HC A02/MF A01 CSCL 11F

Research and development into thermal barrier coatings for electric utility gas turbine engines is reviewed critically. The type of coating systems developed for aircraft applications are found to be preferred for clear fuel electric utility applications. These coating systems consists of a layer of plasma sprayed zirconia-yttria ceramic over a layer of MCrAly bond coat. They are not recommended for use when molten salts are presented. Efforts to understand coating degradation in dirty environments and to develop corrosion resistant thermal barrier coatings are discussed.
Author

**N86-22688*#** Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
**HIGH TEMPERATURE DISPERSION STRENGTHENING OF NiAl Final Report**
Mark Sherman and Krishna Vedula Mar. 1986 15 p refs
(Grant NAG3-387)
(NASA-CR-175073; NAS 1.26:175073) Avail: NTIS HC A02/MF A01 CSCL 11F

A potential high temperature strengthening mechanism for alloys based on the intermetallic compound NiAl was investigated. This study forms part of an overall program at NASA Lewis Research Center for exploring the potential of alloys based on NiAl for high temperature applications. An alloy containing 2.26 at% Nb and produced by hot extrusion of blended powders was examined in detail using optical and electron microscopy. Interdiffusion between the blended Nb and NiAl powders results in the formation of intermediate phases. A fine dispersion of precipitates of a hexagonal, ordered NiAlNb phases in a matrix of NiAl can be produced and this results in strengthening of the alloy by interfering with dislocation motion at high temperature. These precipitates are, however, found to coarsen during the high temperature (1300 K) deformation at slow strain rates and this may impose some limitatioins on the use of this strengthening mechanism.
Author

**N86-22689*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**CORROSION FATIGUE OF 2219-T87 ALUMINUM ALLOY**
Vernotto C. McMillan Feb. 1986 20 p
(NASA-TM-86537; NAS 1.15:86537) Avail: NTIS HC A02/MF A01 CSCL 11F

Corrosion fatigue studies were conducted on bare, chemical conversion coated, and anodized 2219-T87 aluminum alloy. These tests were performed using a rotating beam machine running at a velocity of 2500 rpm. The corrosive environments tested were distilled water, 100 ppm NaCl, and 3.5 percent NaCl. Results were compared to the endurance limit in air. An evaluation of the effect of protective coatings on corrosion fatigue was made by comparing the fatigue properties of specimens with coatings to those without.
Author

**N86-22690#** Denver Univ., Colo. Dept. of Physics.
**HYDROGEN-INDUCED CRACKING IN PURE IRON**
J. H. Armstrong and S. H. Carpenter 1985 5 p Presented at the Conference on Internal Friction and Ultrasonic Attenuation in Solids, Urbana, Ill., 3 Jun. 1985
(Contract DE-AC02-81ER-10958)
(DE86-002078; CONF-8506125-11) Avail: NTIS HC A02/MF A01

The modulus and internal friction of Armco iron were continuously measured during cathodic charging with hydrogen to investigate crack initiation and growth. The observed modulus decrease was attributed to crack initiation and growth. The internal friction increase during cathodic charging was attributed to plastic deformation accompanying the crack formation. Both the modulus and internal friction behavior were found to be a sum of two parallel exponential processes. The two exponential processes were consistent with different sources of carbon for the crack-producing hydrogen bubble nucleation.
DOE

**N86-22691#** Sandia National Labs., Albuquerque, N. Mex.
**ANALYSIS OF FIVE-FOLD SYMMETRY BY MICROTWINNING IN RAPIDLY SOLIDIFIED Al-Mn ALLOYS**
M. J. Carr Oct. 1985 24 p
(Contract DE-AC04-76DP-00789)
(DE86-002636; SAND-85-1872) Avail: NTIS HC A02/MF A01

The properties of small ensembles of cyclically twinned, rhombohedrally distorted face centered cubic crystals are examined and shown to be consistent with reported experimentally determined diffraction patterns and images of rapidly solidified Al-Mn alloys exhibiting icosahedral symmetry. Limitations of previously reported refutations of twinning models are discussed. Proposals are made for definitive tests between microtwinning and quasicrystalline models of these structures.
DOE

**N86-22692#** Argonne National Lab., Ill.
**FREEZING CONTROLLED PENETRATION OF MOLTEN METALS FLOWING THROUGH STAINLESS STEEL TUBES**
J. J. Sienicki, B. W. Spencer, D. L. Vetter, and R. H. Wesel 1985 11 p refs Presented at the National Heat Transfer Conference, Denver, Colo., 4 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-018394; CONF-850810-28) Avail: NTIS HC A02/MF A01

The freezing controlled penetration potential of molten metals flowing within stainless steel structure is important to the safety assessment of hypothetical severe accidents in liquid metal reactors. A series of scoping experiments has been performed in which molten stainless steel and nickel at various initial temperatures and driving pressures were injected downward and upward into 6.4 and 3.3 mm ID stainless steel tubes filled with argon gas and initially at room temperature. In all tests, there was no evidence that the solid tube wall was wetted by the molten metals. The penetration phenomena are markedly different for downward versus upward injections. The dependency upon tube orientation is explained in terms of the absence of wetting. Complete plugs were formed in all experiments halting the continued injection of melt. Calculations with a fluid dynamics/heat transfer computer code show that the injected masses limited by plugging are consistent with freezing through the growth of a stable solidified layer (crust) of metal upon the solid tube wall.
DOE

**N86-22693#** Argonne National Lab., Ill.
**MECHANISTIC MODELING OF ZIRCALOY DEFORMATION AND FRACTURE IN FUEL ELEMENT ANALYSIS**
F. A. Nichols Jun. 1985 31 p refs Presented at the 7th International Conference on Zirconium in the Nuclear Industry, Strasbourg, France, 24 Jun. 1985
(Contract W-31-109-eng-38)
(DE85-018415; CONF-850601-3) Avail: NTIS HC A03/MF A01

The comprehensive model developed in the 1960's at the Bettis Atomic Power Laboratory to explain the creep of Zircaloy during neutron irradiation and applied to fuel element analysis and design is discussed. The in-pile softening observed at low stresses was hypothesized to be due to a combination of the growth-directed Roberts-Cottrell yielding creep originally proposed for (ALPHA)-uranium and the formation of point defect loops

preferentially on certain planes in response to the applied stress, with the second process being of relatively greater importance. The in-pile hardening observed at high stresses (or strain-rates) was proposed to be due to the cutting by dislocations of radiation-produced obstacles. In this stress (strain-rate) region, in-pile behavior was proposed to be identical to post-irradiation behavior. At intermediate stresses (strain-rates) a mechanism of radiation-enhanced climb around obstacles was suggested as being rate controlling. As the stress is decreased, the climb process becomes easier and the rate was then predicted to be controlled by glide at a flow stress characteristic of unirradiated, annealed material, where radiation-enhanced diffusion enabled climbing around the normal strain-hardening obstacles. DOE

**N86-22694#** Argonne National Lab., Ill.
**PREPARATION AND SOME PROPERTIES OF Cu-Li ALLOYS CONTAINING UP TO 20 AT. PERCENT Li**
M. Mendelsohn, A. R. Krauss, and D. M. Gruen 1985 9 p Presented at the ASM Metals Congress - International Conference on Surface Modifications, Toronto, Ontario, Canada, 13 Oct. 1985
(Contract W-31-109-eng-38)
(DE86-001786; CONF-8510160-4) Avail: NTIS HC A02/MF A01

Lithium strongly segregates to the surface of Cu-Li alloys, thus substantially lowering the Cu sputtering yield relative to pure Cu. Use of Cu-Li limiters or divertors in tokamaks can therefore be expected to be beneficial in limiting high-Z plasma impurity influx. A large scale (100 to 200 g) method for the preparation of Cu-Li alloys is described. Analysis reveals that on solidification from the melt stratification occurs which leads to compositional inhomogeneity. The results are discussed in the light of the Cu-Li binary phase diagram and rationalized on the basis of large density differences between Cu and Cu-Li solid solutions. It is concluded that obtaining homogeneous Cu-Li solid solutions is a nontrivial task. DOE

**N86-22695#** Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
**EFFECT OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS Final Report**
M. Meshii Oct. 1985 23 p
(Contract DE-AC02-76ER-01367)
(DE86-001882; DOE/ER-01367/160) Avail: NTIS HC A02/MF A01

The effects of hydrogen on plastic deformation, fracture and microstructure of iron; the effects of irradiation and solutes in flow stress of Nb single crystals; and surface film softening are discussed. DOE

**N86-22696#** California Univ., Berkeley. Lawrence Berkeley Lab.
**PRESSURE DEPENDENCE OF THE SPECIFIC HEAT OF CeAl3**
G. E. Brodale, R. A. Fisher, N. E. Phillips, J. Flouquet, and C. Marcenat Aug. 1985 13 p Presented at the International Conference on Magnetism, San Francisco, Calif., 26 Aug. 1985 Prepared in cooperation with Centre National de la Recherche Scientifique, Grenoble, France
(Contract DE-AC03-76SF-00098)
(DE86-001990; LBL-20219; CONF-850890-20) Avail: NTIS HC A02/MF A01

The specific heat (C) of the heavy-fermion compound CeAl3 has been measured between 0.3 and 20(0)K at pressures to 8.2 kbar. A very strong and nonlinear dependence of C on pressure is observed. The maximum in C/T, which is a prominent feature of zero pressure measurements, disappears under pressure. DOE

**N86-22697#** Oak Ridge National Lab., Tenn.
**EVALUATION OF ELECTROSLAG CASTINGS**
R. R. Judkins and V. K. Sikka 1985 25 p Presented at the Workshop on Electroslag Processing for Marine Applications, Annapolis, Md., 5 Mar. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002210; CONF-8503188-1) Avail: NTIS HC A02/MF A01

Results of evaluations of electroslag castings of ferritic (2-1/4 Cr-1 Mo and 9 Cr-1 Mo) and austenitic (CF8M or type 316) steels are presented. The castings have been characterized for surface finish, cracking, solidification structure, chemical composition, hardness, ferrite distribution, tensile properties, Charpy impact properties, and creep properties. Pertinent data are compared with equivalent data for sand castings and wrought products of the same materials. Based on the results of these studies, the properties of electroslag castings compare favorably with those of sand castings and wrought materials. DOE

**N86-22698#** Oak Ridge National Lab., Tenn.
**THERMAL ANNEALING OF VACANCY AND INTERSTITIAL LOOPS IN ION IRRADIATED COPPER**
B. C. Larson, T. S. Noggle, and J. F. Barhorst Jan. 1985 7 p Presented at the Materials Research Society Annual Meeting, Boston, Mass., 26 Nov. 1984 Prepared in cooperation with Emerson Electric Co., St. Charles, Mo.
(Contract DE-AC05-84OR-21400)
(DE86-002272; CONF-841157-99) Avail: NTIS HC A02/MF A01

X-ray diffuse scattering has been used to study the thermal annealing of vacancy and interstitial loops in Ni-ion irradiated copper. The diffuse scattering formalism is reviewed and diffuse scattering measurements are reported on liquid-He temperature Ni-ion irradiated copper after annealing to 40, 275, and 300(0)C. Size distributions are presented for vacancy and interstitial loops after each anneal and the thermal-induced changes are discussed in terms of loop dissolution and coalescence. DOE

**N86-22699#** Massachusetts Inst. of Tech., Cambridge. Nuclear Reactor Lab.
**ADIP RESEARCH AT MIT Status Report**
N. J. Grant and O. K. Harling Sep. 1985 40 p
(Contract DE-AC02-78ER-10107)
(DE86-002585; DOE/ER-10107/29; MITNRL-014) Avail: NTIS HC A03/MF A01

This report emphasizes the progress made in the project period January to September 1985 in the areas of ferritic alloy development, copper alloy irradiation, and austenitic alloy irradiation. The progress described is also placed in the context of work done in previous project periods, giving a concise summary of the achievements made in these three areas. A summary of the status of the MIT miniature disk bend test is also given. DOE

**N86-22700#** Purdue Univ., Hammond, Ind.
**MATRIX RESEARCH GROUP FOR MATERIALS RESEARCH UTILIZING NSLS Progress Report**
G. L. Liedl Aug. 1985 23 p
(Contract DE-FG02-85ER-45183)
(DE86-002586; DOE/ER-45183/1) Avail: NTIS HC A02/MF A01

MATRIX is a group of scientists from nine institutions who have common interests in utilizing X-ray synchrotron radiation for materials research. This group has available to it a specialized beam line for a wide range of X-ray scattering studies at the National Light Synchrotron Source (NSLS). In the development of this beam line the MATRIX group was a leader in all phases of beam line development. During the past year, MATRIX completed the first operational X-ray scattering beam line at NSLS. In addition, the first X-ray scattering experiment at NSLS was conducted on this beam line. In the past year, eight publications have resulted from the MATRIX supported efforts. Among these publications are four studies related to the beam line development and characteristics. The other publications are research projects of preliminary studies for work at NSLS and include projects on catalysts and phase transformations. Full operational schedules covering the remainder of the calendar year for the beam line were initiated in June 1985. In addition to the first completed project on Diffraction Studies of Langmuir-Blodgett Films, a number of projects on phase transformations, surface studies, catalysts, and electronic materials are in progress. DOE

**N86-22701#** Lawrence Livermore National Lab., Calif.
**THE (57)Fe MAGNETIC HYPERFINE FIELD IN Au-Fe ALLOYS (EVIDENCE FAVORING THE TWO Fe-ENVIRONMENT MODEL OF Au-Fe ALLOYS)**

C. E. Violet, S. P. Verrill, D. J. Balaban, and R. J. Borg Sep. 1985 6 p Presented at the International Conference on Applications of the Mossbauer Effect, Leuven, Belgium, 16 Sep. 1985
(Contract W-7405-eng-48)
(DE86-002599; UCRL-93383; CONF-8509193-1) Avail: NTIS HC A02/MF A01

The results of analysis strongly support the two Fe environment hypothesis. The critical concentration at about 12 at. % suggests that the dependence of H(O, x) on x undergoes a fundamental change at this concentration. Furthermore, the so-called critical concentration at about 17 at. % apparently has little to do with any fundamental alloy property. Rather, it reflects the 12 at. % critical composition when properties are analyzed in terms of the average rather than the local Fe concentration. The two Fe environments appear to have differing configurations. DOE

**N86-22702#** Hanford Engineering Development Lab., Richland, Wash.
**SENSITIZATION OF PARKER FITTINGS**
W. W. Wilber Sep. 1985 8 p
(Contract DE-AC06-76FF-02170)
(DE85-018506; HEDL-7553) Avail: NTIS HC A02/MF A01

At your request, ferrules from 316 SS Parker-Hannifen compression fittings at the FFTF have been examined and evaluated to determine the metallurgical condition as related to carbide precipitation in grain boundaries (known as sensitization) and the implications this may have with regard to corrosion resistance. To accomplish this, two ferrules from new stock, two ferrules from old stock and two ferrules that had seen service were examined metallurgically. The samples were prepared for optical metallography. They were viewed in both the etched and unetched condition and analyzed on the scanning electron microscope (SEM) for elemental content. It was confirmed that the ferrules from new stock had a 5 mil thick nitrided layer on the ferrule ID at the lead end and that the 316 SS ferrule material was in the sensitized condition, indicating low resistance to aqueous corrosion. The material from old stock had no nitride layer but was in the sensitized condition indicating low resistance to aqueous corrosion. The ferrules that had seen service had not been nitrided and were not sensitized indicating high resistance to aqueous corrosion. DOE

**N86-22703#** Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
**FIELD EXPERIMENT TO PARTITION THE EFFECTS OF DRY AND WET DEPOSITION ON METALLIC MATERIALS**
J. W. Spence, F. H. Haynie, E. O. Edney, and D. C. Stiles Sep. 1985 12 p
(PB86-100757; EPA-600/D-85-198) Avail: NTIS HC A02/MF A01 CSCL 11F

At a material exposure site located at the Research Triangle Park, N.C., the Environmental Protection Agency began in 1982 a study to partition the effects of dry and wet deposition on galvanized and weathering steel panels. At the site, air quality and meteorological parameters are continuously measured and reported as hourly averages. The concentration and chemistry of particles and the amount of rainfall and chemistry are also recorded. In this study a mobile device covers a set of panels only during each rain event. Another set of panels is exposed uncovered at the site. The panels are exposed and cleaned according to standard ASTM procedures. After two years of exposure the weight-loss of the galvanized steel for the uncovered exposure was nearly twice the weight-loss recorded for the covered condition. GRA

**N86-22704#** Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
**BRONZE, ZINC, ALUMINUM, GALVANIZED STEEL: CORROSION RATES AS A FUNCTION OF SPACE AND TIME OVER THE UNITED STATES**
D. E. Patterson, R. B. Husar, and E. Escalante Sep. 1985 13 p refs
(PB86-102605; EPA-600/D-85-213) Avail: NTIS HC A02/MF A01 CSCL 11F

A data base of existing metal corrosion data has been compiled by the National Bureau of Standards. The data base contains only exposure studies that were conducted according to standard ASTM procedures and had adequate documentation of the site characteristics and period of exposure. The report presents work conducted at Washington University to examine the exposure data for evidence of key features which may clarify the likely importance of man-made pollutants on the corrosion of metals. GRA

**N86-22705#** Bureau of Mines, Avondale, Md.
**METALLURGICAL EFFECTS OF IMPURITIES IN RECYCLED COPPER ALLOYS**
H. V. Makar and W. D. Riley 1985 26 p
(PB86-126398; BM-IC-9033; LC-85-600046) Avail: NTIS HC A03/MF A01 CSCL 11F

As part of a continuing research program for conserving domestic mineral resources, the Bureau of Mines is investigating new and improved scrap identification techniques to improve sorted mixed scrap purity. This report focuses on various classes of wrought and cast copper alloys produced with recycled scrap. Based on a survey of the literature, principal alloys, such as the brasses and bronzes, are examined with respect to impurity elements and their effects on metallurgical behavior. Effects of elements such as lead, antimony, iron, chromium, and aluminum are discussed. The metallurgical effects described include hot shortness, fire cracking, and undesirable phase transformations. Author (GRA)

**N86-22605#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Materials Section.
**THE DEGRADATION OF METAL SURFACES BY ATOMIC OXYGEN**
A. deRooy *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 99-108 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22616#** Alcan International Ltd., London (England).
**THE DEVELOPMENT OF ALUMINUM-LITHIUM ALLOYS FOR AEROSPACE APPLICATIONS**
A. J. Cornish, A. Gray, W. S. Miller, and M. A. Reynolds *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 195-201 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

# 27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

**N86-22706** Duke Univ., Durham, N. C.
**STRESS-ASSISTED DIFFUSION IN SILICON Ph.D. Thesis**
Michael Lee Manda 1985 204 p
Avail: Univ. Microfilms Order No. DA8523038

Anomalous diffusion behavior of substitional impurities in silicon under thin oxide or nitride films, near mask edges, and in the presence of lattice misfit may be attributable to stresses induced in the silicon wafer by these structures. The role of these process-induced stresses in B and As diffusion was investigated by performing diffusions in samples of ion implanted silicon subjected to 3-point bending. At stresses near the silicon yield stress, no significant enhancement or retardation of B and As diffusion was observed over impurity implant doses ranging from 10 to the 13th power to 10 to the 15th power/cm and annealing temperatures between 800 C and 1050 C. This was true even in plastically deformed samples with dislocation densities exceeding 1,000,000/cm. These results are consistent with both the multiple-charge-state-vacancy model and the activation volume model of

impurity diffusion in the presence of stress. Impurity diffusivities were calculated from concentration versus depth profiles, determined y SIMS analysis, by using a spreading Gaussian technique. The temperature variation of arsenic diffusivity agreed well with accepted values. Low dose boron diffusion, however, was best described by an activation energy of 2.65 + or - .13 eV, in contrast with the 3.46 eV activation energy obtained by most researchers. Dissert. Abstr.

**N86-22707** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**ROLE OF CRACKS IN CREEP OF BRITTLE, POLYCRYSTALLINE, STRUCTURAL CERAMICS Ph.D. Thesis**
Anuradha Venkateswaran 1985 180 p
Avail: Univ. Microfilms Order No. DA8521365

An analytical study was conducted of the effect of cracks on creep of polycrystalline, brittle structural ceramics. Two independent mechanisms of contribution of cracks were defined. The mechanism of elastic creep by crack growth represents the rate of increase in strain, with time, resulting from the time-dependent decrease in elastic moduli of the material, due to crack growth. The mechanism of crack-enhanced creep provides a measure of the increase in creep rate over that in an identical but crack free material, due to the local stress field associated with the cracks and the resultant transfer of stress to the adjacent, crack-free material. Creep rates due to these mechanisms were quantified for simple crack geometries. It was shown that the contribution of cracks can result in an idealized 4-stage creep curve for a brittle polycrystalline ceramic, in contrast to the conventional 3-stage creep curve for metals. A simple model was presented for the effect of cracks on creep rate in bending, based on the time-rate of change of curvature of a bend specimen. Analysis of the effect of cracks on creep was extended to a general state of multiaxial stress, through matrix formulation of stress, creep rate and creep compliance tensors. Dissert. Abstr.

**N86-22708** British Library Lending Div., Boston Spa (England).
**CHROMIUM CARBIDE COATING OF KNT-16 TUNGSTEN-FREE HARD METAL ALLOY**
I. Yu. Konyashin, V. I. Kostikov, I. V. Naratovskii, and A. I. Matlakhov 1985 6 p refs Transl. into ENGLISH from Iz. Vuz Chernaya Metallurgiya (USSR), no. 7, 1985 p 116-118
(BLL-M-36587-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

Trials with tool inserts of hard metal coated by vapor phase deposition of chromium carbide are described. The inserts were tested in simple turning tests and gave much longer tool lives to a preset degree of wear on the flank face. The optimum coating thickness was found to be 6 to 9 microns. Author

**N86-22709** British Library Lending Div., Boston Spa (England).
**ACCELERATING THE PROCESS OF APPLYING MULTI-LAYER COATINGS TO WIRE**
V. Sh. Pavlyutenkova and E. M. Romanova 1985 6 p ref Transl. into ENGLISH from Stal. (USSR), no. 7, 1985 p 61-62
(BLL-M-36571-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

A method of applying multiple copper-nickel coatings to wire is described. The final electrolyte includes nickel sulphamate. The coating sequence and application conditions are given. Accelerated corrosion tests on the wire have provided good results, and tests under natural conditions have shown it to have long life. Author

**N86-22710#** Imperial Coll. of Science and Technology, London (England). Tribology Section.
**PHOSPHORUS ANTI-WEAR ADDITIVES IN HELICOPTER TRANSMISSIONS Final Report**
I. N. Lacey, H. A. Spikes, and P. B. Macpherson Jun. 1985 85 p refs
(Contract MOD(RAE)-A12/1664)
(IC-TS015/85; BR96206) Avail: NTIS HC A05/MF A01

The action on helicopter transmissions of phosphonate ester antiwear additives was studied. It is shown that these additives form thick, polymeric films on rolling and rolling-sliding steel surfaces, and these films are able to greatly increase surface separation above that produced by normal elastohydrodynamic lubrication. Author (ESA)

**N86-22711#** Defence Research Information Centre, Orpington (England).
**WATER-SOLUBLE HIGH POLYMERS AS FLOW ENHANCERS**
Werner Interthal Jun. 1985 45 p refs Transl. into ENGLISH from Die Angewandte Makromolekular Chemie, vol. 123/124, 1984 p 387-417
(DRIC-T-7520; BR96257) Avail: NTIS HC A03/MF A01

The hydrodynamics of flow enhancement are modelled in terms of the uncoiling of the polymer molecules under longitudinal velocity gradients in turbulent boundary flow. Specifications can be derived for candidate molecules in terms of molecular weight, conformation linearity, and electrical charge distribution. Potential industrial applications are considered, giving hydrotransport of sand as an example. Author (ESA)

**N86-22712#** Defence Research Information Centre, Orpington (England).
**THE SURFACE ROUGHNESS OF STRUCTURAL THERMOPLASTIC MOULDINGS**
Jozef Koszkul Sep. 1985 9 p refs Transl. into ENGLISH from Polimery - Tworzywa Wielkoczasteczkowe, vol. 28. no. 8, 1983 p 277-279
(DRIC-T-7572; BR97169) Avail: NTIS HC A02/MF A01

The influence of the injection molding conditions and the roughness of the mold cavity on the roughness of moldings was tested. Results show that the greatest influence on the surface roughness of moldings is exerted by roughness of the mold cavity and the injection temperature. The influence of the injection pressure is less important. An increase in the roughness of the mold cavity causes an increase in the roughness of the molding surface, while an increase in the injection temperature and pressure causes a decrease in it. It is shown that it is possible to write the relationship between the surface roughness of moldings and the injection temperature and pressure as mathematical formulas constituting the result of tests performed according to the statistical multifactorial method of planning of experiments. Author (ESA)

**N86-22713*#** Pratt and Whitney Aircraft, East Hartford, Conn. Engineering Div.
**THERMAL BARRIER COATING LIFE PREDICTION MODEL DEVELOPMENT Annual Report**
Keith D. Sheffler and Jeanine T. DeMasi Nov. 1985 92 p refs (Contract NAS3-23944)
(NASA-CR-175087; NAS 1.26:175087; AR-1) Avail: NTIS HC A05/MF A01 CSCL 11G

A methodology was established to predict thermal barrier coating life in an environment simulative of that experienced by gas turbine airfoils. Specifically, work is being conducted to determine failure modes of thermal barrier coatings in the aircraft engine environment. Analytical studies coupled with appropriate physical and mechanical property determinations are being employed to derive coating life prediction model(s) on the important failure mode(s). An initial review of experimental and flight service components indicates that the predominant mode of TBC failure involves thermomechanical spallation of the ceramic coating layer. This ceramic spallation involves the formation of a dominant crack in the ceramic coating parallel to and closely adjacent to the metal-ceramic interface. Initial results from a laboratory test program designed to study the influence of various driving forces such as temperature, thermal cycle frequency, environment, and coating thickness, on ceramic coating spalling life suggest that bond coat oxidation damage at the metal-ceramic interface contributes significantly to thermomechanical cracking in the ceramic layer. Low cycle rate furnace testing in air and in argon clearly shows a dramatic increase of spalling life in the non-oxidizing environments. Author

**N86-22714#** Rutgers - The State Univ., Piscataway, N. J. High Pressure Materials Research Lab.

**MEMORY BEHAVIOR OF AN ELASTOMERIC GLASS BY PRESSURE- AND TEMPERATURE-PERTURBATION METHODS**
J. Vijayan and K. D. Pae 10 Dec. 1985 19 p
(Contract N00014-82-K-0608)
(AD-A162597; TR-6) Avail: NTIS HC A02/MF A01 CSCL 11/10

The memory behavior of structural relaxation of glass of Solithane 113 - a polyurethane elastomer, by pressure perturbation and also by temperature perturbation from an original state of pressure and temperature (P,T) of 2.5 KBar and 15 C, is reported. The Young's modulus, obtained from the compressive stress-strain curves of the glassy samples, is used as a parameter to study its aging behavior. The liquid samples were transformed to a glass at a fixed point 2.0 KBar and 15 C. They were subjected to different hydrostatic pressure levels above 2.5 KBar, viz., 3.0, 4.0 and 4.5 KBar at 15 C and held at those pressure levels for 10 hours. The pressure was released to 2.5 KBar and the samples were then tested in compression after different aging time. Temperature perturbation experiments were carried out similarly, i.e., the samples at 2.5 KBar were initially annealed for 10 hours at lower temperatures, viz., 10 C, 5 C and 0 C, heated back to 15 C and then tested after different aging time. In both cases, the perturbed glass shows higher initial Young's modulus than that of unperturbed glass, followed by gradual decrease with aging time. All relaxation curves trace eventually back to the unperturbed with longer aging time. The higher the perturbation, the shorter it takes to trace back to the unperturbed. GRA

**N86-22715#** Lawrence Livermore National Lab., Calif.
**PROGRESS IN DEVELOPMENT OF LOW DENSITY POLYMER FOAMS FOR THE ICF PROGRAM**
S. A. Letts, L. M. Lucht, R. J. Morgan, R. C. Cook, T. M. Tillotson, M. B. Mercer, and D. E. Miller 10 Jun. 1985 40 p
(Contract W-7405-eng-48)
(DE86-001928; UCID-20537) Avail: NTIS HC A03/MF A01

The status of CH foam development with densities of 50 mg/ccs and cell sizes of 1 micron for the ICF Program is described. Two approaches that both involve polymer phase separation are being investigated. The first involves a gelation-crystallization of high molecular weight polyethylene from solution, whereas the second approach involves the modification of the phase separation morphology of water-styrene emulsions by molecularly-tailored surfactants followed by polymerization of the continuous styrene phase. DOE

**N86-22716#** Oak Ridge National Lab., Tenn.
**HIGH TEMPERATURE THERMAL CONDUCTIVITY OF A FIBROUS ALUMINA CERAMIC**
R. E. Pawel, D. L. McElroy, F. J. Weaver, and R. S. Graves 31 Jul. 1985 26 p
(Contract W-7405-eng-48)
(DE86-002487; UCID-20551) Avail: NTIS HC A03/MF A01

Steady-state thermal conductivity measurements on a fibrous alumina specimen were made in neon and nitrogen gases at reduced pressures at temperatures from 400 to 1200 K. A radial heat flow apparatus was employed. A simplified parallel-series model for heat transport in a two-phase material was used to construct a functional representation for the thermal conductivity by means of standard curve-fitting procedures. These analyses defined the relative importance of the solid, gas, and radiative properties to the transport of heat in this material, and served as a basis for tentative extrapolations outside the range of our available data. DOE

**N86-22717#** Sandia National Labs., Albuquerque, N. Mex.
**EVALUATION OF A NEW REMOVABLE ENCAPSULANT, MICROLITE 206**
H. W. Arris Oct. 1985 18 p
(Contract DE-AC04-76DP-00789)
(DE86-002637; SAND-85-0979) Avail: NTIS HC A02/MF A01

Solvent removable bead foam encapsulants have been developed to provide a rework capability for complex and expensive weapon hardware. Recently, a new bead foam product, Microlite 206, became commercially available; this material is being considered as a removable encapsulant. Microlite 206 is a copolymer of vinylidene the same as polystryrene bead foams. Characterization studies indicated Microlite 206 has similar mechanical properties compared to polystyrene bead foams at equivalent densities; however, it was found to be incompatible with certain metals such as silver and copper. Since these metals are an integral part of most electronic components, the use of Microlite 206 as an encapsulant would not be recommended. Yet, for select applications Microlite 206 may be a satisfactory substitute for polystyrene bead foam. DOE

**N86-22718#** Sandia National Labs., Albuquerque, N. Mex.
**MECHANICAL PROPERTIES OF AN ALUMINUM-FILLED EPOXY**
W. A. Olsson and A. K. Jones Nov. 1985 23 p
(Contract DE-AC04-76DP-00789)
(DE86-003963; SAND-85-2133) Avail: NTIS HC A02/MF A01

A mechanical testing program has been carried out on an aluminum-filled epoxy. This material is used in the construction of stress gages that are used near underground explosions. The properties are needed to properly calibrate the gages. The block from which the test samples were taken was characterized by measuring density and ultrasonic compressional and shear wave velocities. Test types included hydrostatic compression, triaxial compression, uniaxial strain loading followed by uniaxial strain unloading, and uniaxial strain loading followed by biaxial unloading. The highest confining pressures reached were in the neighborhood of 700 MPa. The material was found to be nonlinear over the entire range of each of the investigated variables. The stress-strain response can be classified as nonlinear, plastic-hardening; there is no definite yield point. Hardening rates increase with increasing confining pressure. DOE

**N86-22719#** Lawrence Livermore National Lab., Calif.
**VISCOELASTIC AND AGING CHARACTERISTICS OF POLYMER**
W. W. Feng 1985 4 p Presented at the 190th American Chemical Society National Meeting, Chicago, Ill., 8 Sep. 1985
(Contract W-7405-eng-48)
(DE85-016083; UCRL-90085; CONF-850942-28) Avail: NTIS HC A02/MF A01

Study of mechanics for polymeric materials must consider both geometric and material nonlinearities. The additional viscoelastic and aging effects make the analytical study very difficult. In this paper, the viscoelastic effect of polymers subjected to simple extension is presented. The constitutive equation developed by Christensen is used. With two more material property functions, the constitutive equation is extended to include the aging effect of polymers. In experiments, the relaxation data for both unaged and aged specimens are obtained. Based on the formulation and test data, the viscoelastic and aging material properties are determined. DOE

**N86-22720#** Idaho National Engineering Lab., Idaho Falls.
**INORGANIC MEMBRANE TECHNOLOGY**
R. R. McCaffrey, R. E. McAtee, A. E. Grey, C. A. Allen, A. D. Appelhans, R. B. Wright, and J. G. Jolley 1985 21 p Presented at the 4th Symposium on Separation Science and Technology for Energy Applications, Knoxville, Tenn., 20 Oct. 1985
(Contract DE-AC07-76ID-01570)
(DE86-002313; EGG-M-04585; CONF-851011-4) Avail: NTIS HC A02/MF A01

The objective of this program is to develop a variety of inorganic based high temperature separation membranes. Organic membranes are limited by temperature (100 C) environments, and would be unsuitable for high temperature applications. The higher temperature stabilities of inorganic materials make them ideal candidates for high temperature membrane applications. Inorganic polymer materials, such as the polyphosphazenes, are being examined for mid-temperature membrane separation applications (100 C) to 350 C) Metallic and ceramic membrane materials are being examined for high temperature separation applications 350 C

to 1000 C). The liquid and gas membrane test systems developed for this program are described. Preliminary results on the separation properties of poly bis- (2,2,2 trifluoroethoxy) phosphazene membranes are reported for dilute aqueous methanol, ethanol, isopropanol, and phenol feedstreams. DOE

**N86-22721#** Sandia National Labs., Albuquerque, N. Mex.
**MEASUREMENT OF MELT AND SOLIDIFICATION DYNAMICS DURING PULSED LASER IRRADIATION**
P. S. Peercy 1985 58 p Presented at the NATO Advanced Study Institute, San Miniato, Italy, 2 Sep. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002589; SAND-85-1349C; CONF-8509150-2) Avail: NTIS HC A04/MF A01

Simultaneous measurements of the transient conductance and the time-dependent surface reflectance are reviewed. These real-time measurements have been applied in Si and Si-based alloys. Studies in silicon on sapphire demonstrate that melt initiates at the surface and propagates to some depth, whereupon the motion of the liquid/solid interface reverses, the material solidifies, and the interface returns to the surface. Comparison of solidification velocities for bulk Si with numerical heat flow calculations demonstrates that the laser melting process can be understood on the basis of a purely thermal model under equilibrium conditions. In amorphous Si, the transient conductance measurements permits the melting temperature of the amorphous phase to be determined. The melting temperature of amorphous Si is reduced by 225 K relative to the melting temperature of crystalline Si, and explosive crystallization of amorphous Si is observed to be mediated by a thin molten layer that propagates at approx. 14 m/s. The reduced melting temperature of amorphous Si is confirmed by studies on Si-Ge alloys. Measurements of the melt dynamics with short (approx. 3 ns) pulse irradiation are used to estimate the velocity-undercooling relationship in Si. In Si containing metastable concentrations of substitutional As, the effect of As on the solidification velocity permits the metastable melting temperatures to be determined. Combined transient conductance and surface reflectance studies permit examination of internal nucleation of melt and surface nucleation of solid. These buried molten layers lead to novel microstructures. Recent extensions of the technique to metallic systems are summarized. DOE

**N86-22722#** Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.
**VACUUM ULTRAVIOLET ELECTRONIC PROPERTIES OF LIQUIDS Annual Progress Report, 1 Feb. 1985 - 31 Jan. 1986**
L. R. Painter Sep. 1985 24 p
(Contract DE-AS05-76EV-03861)
(DE86-001892; DOE/EV-03861/50) Avail: NTIS HC A02/MF A01

Topics covered in the Annual Report of the Tennessee University Department of Physics and Astronomy include collective oscillation in liquid silicone, electron emission, n-ethylene glycols, liquid water, and conductivity measurements. DOE

**N86-22607#** United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
**CONDUCTIVE COATINGS TO MINIMISE THE ELECTROSTATIC CHARGING OF KAPTON**
D. Verdin and M. J. Duck *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 125-131 refs Sponsored by UK Ministry of Defence Procurement Executive (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22609#** AEG-Telefunken, Frankfurt am Main (West Germany). Forschungsinst.
**ON DIELECTRIC LONG TERM STABILITY OF KAPTON-FILMS STRESSED BY ac AND dc UNDER USUAL ATMOSPHERIC CONDITIONS AND IN VACUUM**
W. Goelz *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 143-148 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22610#** Imperial Chemical Industries, Wilton (England). New Science Group.
**MECHANICAL AND FIRE PROPERTIES OF AROMATIC POLYMER COMPOSITES**
D. C. Leach, P. J. Briggs, and D. R. Carlile *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 153-160 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22613#** Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France).
**WINDING WITH THERMOPLASTIC POLYMERS**
J. L. Tisne and J. Bouvard *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 173-178 refs Sponsored by ESA (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22620#** Selenia S.p.A., Rome (Italy).
**MEASUREMENT OF THE THERMO-OPTICAL PROPERTIES OF VARYING PAINT THICKNESS ON CARBON FIBER COMPOSITES IN SPACECRAFT STRUCTURES**
M. Giommi, M. Marchetti (Rome Univ., Italy), G. Salza, and P. Testa (Rome Univ., Italy) *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 233-238 refs Sponsored by Max-Planck Inst. (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22621#** Centre National d'Etudes Spatiales, Toulouse (France).
**NEW SPACE PAINTS**
J. C. Guillaumon *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 239-243 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22622#** Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
**LONG TERM TESTS OF CONTAMINATED OPTICAL SOLAR REFLECTORS (OSRS) UNDER COMBINED ENVIRONMENT**
J. Marco and A. Paillous *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 245-253 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22675#** Joint Publications Research Service, Arlington, Va.
**ULTRASOUND-BASED METHOD FOR STUDIES ON COMPRESSION MOLDING KINETICS OF PLASTICS Abstract Only**
E. A. Tagiyev, Ye. B. Raskin, and M. S. Trizno *In its* USSR Report: Chemistry (JPRS-UCH-86-002) 5 Feb. 1986 p 4 Transl. into ENGLISH from Plasticheskiye Massy (Moscow, USSR), no. 6, 1985 p 60-61 (For primary document see N86-22673 13-25)
Avail: NTIS HC A04/MF A01

**N86-22676#** Joint Publications Research Service, Arlington, Va.
**APPLICATION OF CHN-2 ANALYZER IN DETERMINATION OF ELEMENTAL COMPOSITION OF ORGANIC POLYMERS Abstract Only**
Z. N. Zigel, V. M. Ryabikova, O. G. Utkina, and I. T. Korzhova *In its* USSR Report: Chemistry (JPRS-UCH-86-002) 5 Feb. 1986 p 4-5 Transl. into ENGLISH from Plasticheskiye Massy (Moscow, USSR), no. 6, 1985 p 43-45 (For primary document see N86-22673 13-25)
Avail: NTIS HC A04/MF A01

**N86-22765#** Joint Publications Research Service, Arlington, Va.
**DESIGNING OF BIOPOLYMERS DISCUSSED**
Tatsuo Oci *In its* Japan Report: Science and Technology (JPRS-JST-86-006) 18 Mar. 1986 p 35-47 refs Transl. into ENGLISH from Bio Industry (Tokyo, Japan), Sep. 1985 p 41-49 (For primary document see N86-22764 13-31)
Avail: NTIS HC A04/MF A01

# 28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

**N86-22723#** Naval Research Lab., Washington, D. C.
**MIST FLAMMABILITY STUDIES OF CANDIDATE FIRE-RESISTANT HYDRAULIC FLUIDS**
R. C. Little, S. Pande, and J. B. Romans 6 Nov. 1985 27 p (AD-A161299; NRL-MR-5661) Avail: NTIS HC A03/MF A01 CSCL 11/8

Using NRL's mist flammability test apparatus, several commercial samples of 40% water-in-oil emulsion (fire-resistant hydraulic fluids) were screened for fire resistency. For comparison purposes, two other commercial fire-resistant hydraulic fluids were screened viz., a water-glycol solution and a phosphate ester. The Navy's currently used petroleum-type hydraulic fluid, 2190-TEP, was employed as the reference fluid. At the most severe conditions investigated (i.e., spray disk tangential velocity of 67.8 m/s, and fluid flow rate of 850 ml/min), none of the fire-resistant hydraulic fluids exhibited ignition leading to propagation in the presence of the propane test flame, indicating fire resistancy under these conditions. Under identical operating conditions, 2190-TEP exhibited gross ignition with propagation of flame ranging from 180 deg to 360 deg around the spinning disk, indicating it to be a potential fire hazard. The physical and chemical characteristics of the 40% water-in-oil emulsions suggest that this class of fire-resistant hydraulic fluids may be suitable replacement candidates for 2190-TEP. GRA

**N86-22724#** Suntech, Inc., Marcus Hook, Pa.
**TURBINE FUELS FROM TAR SANDS BITUMEN AND HEAVY OIL. PHASE 1: PRELIMINARY PROCESS ANALYSIS Interim Report, 8 Jul. 1983 - 9 Apr. 1984**
A. F. Talbot, V. Elanchenny, A. Macris, and J. P. Schwedock 9 Apr. 1985 183 p
(Contract F33615-83-C-2352)
(AD-A161300; AFWAL-TR-85-2013) Avail: NTIS HC A09/MF A01 CSCL 21/4

The strategic potential of domestic bitumens and heavy crude oils as substitutes for imported crude rests with their efficient conversion into aviation turbine fuels. In this Phase 1 study, preliminary analyses of several processing schemes have been performed. The comparison included both hydrogen addition and carbon rejection upgrading processes. Projected JP-4 yields, costs, and thermal efficiencies suggest further exploration of the hydrovisbreaking process. For Phase 2, laboratory scale demonstration of the recommended process is proposed. GRA

**N86-22725#** Lawrence Livermore National Lab., Calif.
**DEVELOPMENT OF A DETAILED KINETIC REACTION MECHANISM FOR THE OXIDATION OF n-OCTANE AND Iso-OCTANE**
C. K. Westbrook and E. Axelsson 1 Oct. 1985 27 p refs Presented at the Two Phase Combustion, Numerical Modelling of Combustion Processes: General Combustion Topics, Davis, Calif., 21 Oct. 1985 Prepared in cooperation with AB Volvo, Goeteborg, Sweden
(Contract W-7405-eng-48)
(DE86-001722; UCRL-93420; CONF-8510158-3) Avail: NTIS HC A03/MF A01

The development of detailed chemical kinetic reaction mechanisms for the oxidation of n-octane and iso-octane is described. The elementary reactions describing the thermal decomposition and H atom abstractions of the octane molecules, the thermal decomposition reactions of the resulting alkyl radicals, and the abstraction and addition reactions of the intermediate olefin and other species are discussed. In many cases, the assignment of specific rate expressions for these reactions is made, and the identification of probable reaction products is attempted. The reaction mechanisms for the two forms of octane are compared and contrasted, and the relationships between the two mechanisms are used to explain some of the observed differences in the combustion characteristics of the two fuels. DOE

**N86-22726#** Lawrence Livermore National Lab., Calif.
**EIGHTH INTERNATIONAL SYMPOSIUM ON DETONATION, VOLUME 2**
1985 208 p Proceedings of the 8th International Symposium on Detonation, Albuquerque, N. Mex., 15 Jul. 1985
(Contract W-7405-eng-48)
(DE86-002616; CONF-850706-Vol-2) Avail: NTIS HC A10/MF A01

Volume two contains twenty-three papers on chemical explosives and detonations. Papers are grouped under the following topics: equation of state; shock-to-detonation transition/deflagration-to-detonation transition; hot spots; detonation spectroscopy; initiation and sensitivity; and reaction zones. All papers have been processed for inclusion in the Energy Data Base. DOE

**N86-22760#** Joint Publications Research Service, Arlington, Va.
**STUDY OF PREDICTION OF LIQUID FUEL CAPTURE BY FLAMEHOLDER DOWNSTREAM OF PLAIN ORIFICE INJECTOR UNDER UNIFORM CROSS AIR FLOW Abstract Only**
Junyong Zhu, Rushan Jin, and Minghua Cao *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 136 Transl. into ENGLISH from Yuhang Xuebao (Beijing, China), no. 4, 31 Oct. 1985 p 8-15 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

# 31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

**N86-22727#** Royal Aircraft Establishment, Farnborough (England).
**TRIAL OF THE INERT GAS SYSTEM ON RFA BAYLEAF**
K. C. Hayden 16 Nov. 1984 16 p refs
(RAE-TM-NAV-ENG-1050; BR94940) Avail: NTIS HC A02/MF A01

The inert gas (IG) system and its operation are described and the benefits of IG on tanker safety are discussed. The effect of IG on AVCAT F-44 quality was determined during a trial on a tanker ship. No adverse effects on the AVCAT cargo are revealed and the benefits of employing IG systems on tankers are considerable if low flash point products are carried, e.g., CIVGAS F-50. For higher flash point fuels an IG system is not essential.
Author (ESA)

**N86-22728#** New Mexico Univ., Albuquerque. Engineering Research Inst.
**PERMEABILITY EQUIPMENT FOR POROUS FRICTION SURFACES Interim Report, Oct. 1984 - Apr. 1985**
Daniel L. Standiford, Richard A. Graul, and Lary R. Lenke Apr. 1985 54 p refs
(Contract F29601-84-C-0080)
(DOT/FAA/PM-85/31; ESL-TR-85-22) Avail: NTIS HC A04/MF A01

Hydroplaning is the loss of traction between tires and pavement due to the presence of a layer of water. This loss of traction can result in loss of vehicle control. A porous friction surface (PFS) applied over an existing pavement permits the water to drain laterally and vertically away from the tire path, effectively lowering

hydroplaning potential. Equipment used to measure pavement drainage (permeability) is discussed with respect to usage on porous friction surface. Background information on hydroplaning, flow theory, and PFS field performance as they are affected by permeability are also presented. Two dynamic test devices and four static devices are considered for measuring PFS permeability. Permeability tests are recommended to measure PFS permeability for maintenance purposes and construction control. Dynamic devices cited could possibly estimate hydroplaning potential; further research must be done to determine this. Permeability devices cannot be used to accurately estimate friction of a pavement surface, however, decreased permeability of a pavement infers a decrease in friction. Author

**N86-22729#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NUMBER 1985-1, 224/JANUARY-FEBRUARY**
Claude Sevestre, ed. ESA Oct. 1985 70 p refs Transl. by ONERA into ENGLISH of 'La Recherche Aerospatiale, Bulletin Bimestriel" (Paris, France), No. 1985-1, 224/Jan.-Feb. 1985
(ESA-TT-915) Avail: NTIS HC A04/MF A01; print copy in ENGLISH available at ONERA, Paris FF70; original report in FRENCH available at ONERA, Paris FF70

Aerodynamic methods for designing advanced high-speed propellers; a holography stand for high-definition image recording of transparent or opaque images; numerical analysis of singular stress fields at the free edge of layered composites; structure calculations in cyclic viscoplasticity; aircraft pseudo-noise and noise; and use of a radiance amplifier for visualizing seeded aerodynamic flows are discussed. Author (ESA)

**N86-22730#** Lanchester Polytechnic, Coventry (England). Dept. of Mechanical Engineering.
**VERIFICATION OF THE LIQUID CRYSTAL/HEATER TECHNIQUE FOR HEAT TRANSFER MEASUREMENT IN CONFINED FLOWS**
M. R. Butcher, B. L. Button, D. Wilcock, and C. C. Wright 1985 7 p refs Presented at Developments in Measurements and Instrumentation in Engineering Conference, Hatfield, England, 11-13 Sep. 1985; sponsored by Hatfield Polytechnic and Institution of Mechanical Engineers Sponsored by UK Science and Engineering Council
(ISBN-0-85298-583-5) Avail: NTIS HC A02/MF A01

Heat transfer measurements using liquid crystals were carried out for fully developed turbulent flow in a horizontal pipe to verify the technique for confined flows using a well studied situation. Copper wire 90 diameters downstream of the entrance of the tube was wound around the tube for a length of 300 mm and produced the constant surface heat flux at the end of which the temperature profile was fully developed. It is found that the heat transfer distribution along the tube can be observed by noting the color distribution of the liquid crystal. The only significant heat loss is found to be that due to radiation. Excellent agreement is obtained with Engineering Sciences Data Unit (1977) data after accurate measurements of bulk temperature were made by measuring the center line temperature in the fully developed state and correcting for bulk temperature upstream. Author (ESA)

**N86-22731#** Bureau of Mines, Minneapolis, Minn.
**BLAST VIBRATION MEASUREMENTS NEAR AND ON STRUCTURE FOUNDATION Investigations Report, 1985**
D. E. Siskind and M. S. Stagg 1985 27 p
(PB86-106028; BM-RI-8969; LC-85-600074) Avail: NTIS HC A03/MF A01 CSCL 08I

Blasting year structures often involves measurement of vibrations for the assessment of damage potential. Several methods of measurement are in use worldwide, but there is no consensus as to which methods are technically sufficient and yet practical for all situations. This Bureau of Mines study examined five methods of vibration transducer placement to determine the best method for monitoring blasting vibrations. The methods examined were burial in soil next to the structure; attachment to the foundation at ground level, to the basement floor, or to a surface slab; and burial at a distance from the structure in undisturbed soil. Typical surface mine production blasts were used as vibration sources. GRA

**N86-22732#** Stirling Power Systems Corp., Ann Arbor, Mich.
**PHASE 1-B DEVELOPMENT OF KINEMATIC STIRLING/RANKINE COMMERCIAL GAS-FIRED HEAT PUMP SYSTEM Annual Report, Sep. 1983 - Dec. 1984**
L. Johansson, J. G. Agno, and W. H. Percival Jul. 1985 100 p
(Contract GRI-5083-242-0845)
(PB86-104767; GRI-85/0126) Avail: NTIS HC A05/MF A01 CSCL 13A

The goal of this project is to develop a commercial size Stirling engine-driven gas heat pump with a cooling capacity of 10-ton, and a COP (heating) of 1.8 and COP (cooling) of 1.1. The project is a multi-phase development with commercialization planned for 1989. To date, a piston type open shaft refrigeration compressor has been selected as the best match for the engine. Both the engine and compressor have been tested and characterized by performance maps, and the experimental heat pump systems designed. The manufacturer has continued to focus on improving the Stirling engine performance and reliability for the gas heat pump application. GRA

**N86-22733#** PEI Associates, Inc., Cincinnati, Ohio.
**CARBON MONOXIDE ANALYSIS OF FUTURE ATTAINMENT OF THE NAAQS (NATIONAL AMBIENT AIR QUALITY STANDARD) IN WICHITA, KANSAS Final Report**
G. J. Schewe Jun. 1985 110 p
(Contract EPA-68-02-3890)
(PB86-119906; EPA-907/9-85-004) Avail: NTIS HC A06/MF A01 CSCL 14B

In order to comply with the NAAQS for CO in Wichita, Kansas, a special study was performed to demonstrate that CO concentrations at a special purpose monitor (SPM) located near Douglas and Main Streets would give results less than the NAAQS by 1987. The SPM site is located near the urban core in an area characterized by high nighttime traffic volumes and congested traffic flow. A dispersion modeling analysis was performed using the CALINE-3 Model for dispersion, the MOBILE-3 Model for vehicle emissions and local or national traffic and ambient conditions. Results of modeling the SPM site for baseline (1983) emissions were calibrated with maximum measured CO concentrations. Several scenarios were analyzed in this analysis including with and without the inspection/maintenance program and with and without the left-turn ban from Douglas to Main Streets. GRA

**N86-22734#** Research Triangle Inst., Research Triangle Park, N.C.
**ADVANCED ELECTROSTATIC ENHANCEMENT OF FABRIC FILTRATION**
R. B. Mosley, L. S. Hovis, N. Plaks, T. Yamamoto, and A. S. Viner Oct. 1985 25 p
(Grant EPA-R-812281)
(PB86-117371; EPA-600/D-85-267) Avail: NTIS HC A02/MF A01 CSCL 13B

Laboratory and pilot plant studies of a modification of the U.S. EPA's Electrically Stimulated Fabric Filtration (ESFF) method in which corona voltage on a center-wire electrode replaces the subcorona electrodes at the bag surface are discussed. The electric field which affects enhancement results from the high potential maintained on the center wire. The mechanism that supports the observed increase in gas flow consistent with the theoretical model involves the nonuniform deposition of the charged dust as a result of forces exerted on the particles in the electric field perpendicular to the bag. Laboratory results show an extremely low rate of pressure drop increase during the filtration cycle, only 10 to 30% of the rate associated with conventional reverse-air fabric filtration. Pilot plant data indicate a corresponding increase in flow through electrified bags. The rudiments of a mathematical model for describing the electrical deposition of the dust are presented. GRA

**N86-22735#** Joint Publications Research Service, Arlington, Va.
**CHINA REPORT: SCIENCE AND TECHNOLOGY**
28 Jan. 1986 109 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-004) Avail: NTIS HC A06/MF A01

Various areas of scientific research in China is reported. The increased use of computers in economic development, information systems and meteorological work is described. Aircraft engine design and testing facilities are briefly discussed. The biological treatment of waste water is another area of discussion. For individual titles, see N86-22736 through N86-22740.

**N86-22736#** Joint Publications Research Service, Arlington, Va.
**STATUE OF AIRCRAFT ENGINE RESEARCH AT NPU REVIEWED** **c07**
*In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 40-45 refs Transl. into ENGLISH from Guoji Hangkong (Beijing, China), no. 10, Oct. 1985 p 4-6 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

The aircraft engine research work at Northwest Polytechnic University is intended to satisfy the needs of national defense and the aviation industry on the one hand, and to serve China's economic development on the other. The efforts were devoted to the following two areas: (1) exploring advanced design methods of high-performance propulsion systems, studying new topics in jet propulsion technology, developing our experimental capabilities and striving to improve measurement techniques; and (2) providing wide range of technical services to the mechanical, power, energy exploration and local industries in the areas of product design, application of new technologies, and development of new energy sources. Modern jet propulsion technology is closely tied to state-of-the-art scientific development and the development of electronic computers; it has evolved from a single technical discipline to the combined study of many different disciplines. The areas of research are discussed briefly. Author

**N86-22737#** Joint Publications Research Service, Arlington, Va.
**SHANGHAI'S OUTDOOR AEROENGINE TEST FACILITY DETAILED** **c09**
*In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 46-50 Transl. into ENGLISH from Hangkong Zhizao Gongcheng (Beijing, China), no. 7, 1 Jul. 1985 p 1-4 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

In November 1983, the outdoor test facility of the Shanghai Aircraft Engine Factory was officially certified by the technical certification conference sponsored by the National Defense Science and Engineering Committee, and was named the Shanghia Outdoor Test Facility for Aircraft Engines. As China's first outdoor test facility, it was designed to perform the essential functions of new engine development, verification of engine performance, establishing momentum corrections for indoor test facilities, and studying the effect of weather and environmental conditions on engine performance. Author

**N86-22738#** Joint Publications Research Service, Arlington, Va.
**APPLICATIONS OF HIRFL HEAVY ION ACCELERATOR SURVEYED** **c73**
Guohua Wu *In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 51-58 Transl. into ENGLISH from Wuli Tongbao (Baoding, China), no. 4, 10 Aug. 1985 p 23-28 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

China had a late start in the research of heavy ion physics, partly due to the lack of a suitable accelerator. In 1970 the Modern Physics Institute converted an ordinary 1.5m light particle accelerator into a heavy ion accelerator. A series of nuclear physics and nuclear chemistry studies using accelerated carbon, nitrogen and oxygen has led to encouraging results and filled the void in this area. However, this 1950 vintage accelerator is far from adequate. In 1973 a proposal was submitted for the construction of a new accelerator, an evaluation meeting was held in 1974, and in November 1976, the State officially granted the permission to build a heavy ion accelerator in Lanzhou. Today, the earth work construction has been essentially completed and components are being fabricated and tested for an opening date in 1188. This accelerator will provide the esearch and application of heavy ion physics with an advanced facility and will become China's own heavy ion physics research center. Author

**N86-22739#** Joint Publications Research Service, Arlington, Va.
**ANAEROBIC BIOLOGICAL TREATMENT OF WASTEWATER CONTAINING TNT, RDX** **c45**
Yuxiang Xue and Jainyong Jin *In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 68-77 Transl. into ENGLISH from Zhongguo Huanjing Kexue (Beijing, China), v. 5, no. 5, 21 Oct. 1985 p 2-7 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

The anaerobic biological treatment of wastewater containing TNT, RDX, or a TNT-RDX mixture was tested through small scale and production scale trials with good results that meet the anticipated goals. After treatment, the TNT and RDX content of water and the major indicators such as COD and BOD all fall within the national discharge standards. At present, it has been formally put into operation and applied to the treatment of loading plant wastewater containing a mixture of TNT and DNN (dinitronaphthalene). Author

**N86-22740#** Joint Publications Research Service, Arlington, Va.
**STUDIES OF THE PROPERTIES OF DEGRADATION OF INORGANIC CYANIDE IN THE GAS-PRODUCING WASTEWATER BY ARTIFICIAL SCREENING CYANIDE-DECOMPOSING BACTERIA STRAINS Abstract Only** **c45**
*In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 89 refs Transl. into ENGLISH from Zhongguo Huanjing Kexue (Beijing, China), v. 5, no. 5, 21 Oct. 1985 p 27-32 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

Five highly efficient decyanide bacteria strains have been isolated from sludge of an effluent outlet of cyanide-containing gas-producing wastewater and the biofilm of a biological trickling filter tower of a synthetic ammonia factory. A strain of these cyanide-decomposing bacteria was identified as Arthrobacter sp. no. 8. Their average biodegradation efficiency for inorganic cyanides was 93.1 percent when the initial concentration of the cyanide was 25.02-27. 93 mg/1, while the highest removal efficiency was 96.8 percent. The results of tests indicate that Arthrobacter sp. no. 9 can use inorganic cyanides as the sole soruce of nitrogen and carbon for its growth. The similar high decomposition efficiency with total removal rate of 91.53 percent was obtained in the direct treatment of gas-producing wastewater containing inorganic cyanide by the mixed bacterial culture mainly of the above five artificial screening strains. Studies of the condition of CN- degradation in the process of growth of the decyanide strains are reported. Author

**N86-22741#** Joint Publications Research Service, Arlington, Va.
**CHINA REPORT: SCIENCE AND TECHNOLOGY**
13 Feb. 1986 65 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-006) Avail: NTIS HC A04/MF A01

Several topics relative to Chinese science and technology are discussed. The lifetime of excimer lasers, space warfare, output obtained from XeCl excimer lasers, the measurement of the velocity distribution of atomic beams, plasma physics research and a screen editing program using Chinese characters are among the topics covered. For individual titles, see N86-22742 through N86-22747.

**N86-22742#** Joint Publications Research Service, Arlington, Va.
**SPECTER OF WAR IN SPACE DISCUSSED, PART 2** **c18**
Xianmin Bao *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 1-7 Transl. into ENGLISH from Hangtian (Beijing, China), no. 6, Nov. 1985 p 8-11 (For primary document see N86-22741 13-31)

Avail: NTIS HC A04/MF A01

In the fall of 1968, the Soviet Union launched an artificial satellite Cosmos 249 into an elliptic orbit from the Tyuratam base near the Aral Sea. But shortly afterwards, the satellite drifted away from its perigee at 500 km altitude and exploded. Ten days later, the Cosmos 252, which was launched into a similar orbit, also disappeared after an explosion. The explosions of Cosmos 249 and Cosmos 252 occurred after the satellites had approached and rendezvoused with Cosmos 248. It was discovered that these were actually Soviet tests in which fragments from an exploding satellite were used to destroy enemy satellites. Subsequently, the Soviet Union tested other attack strategies: for example, attacking the target satellite from the same circular orbit; approaching the target satellite from an elliptic orbit before attacking; and attacking the target by a sudden climb maneuver without entering the target satellite orbit. In June 1982, the Soviet Union conducted a space war exercise which greatly surprised the United States. During the exercise, intercept satellites were first launched to destroy U.S. reconnaissance satellites and communications satellites; at the same time the satellites were being attacked, two ICBM's, an SLBM, an IRBM, the SS-20 and an anti-ballistic missile were also launched. Author

**N86-22743#** Joint Publications Research Service, Arlington, Va.
**LIFETIME OF EXCIMER LASER STUDIED** **c36**
Xuejin Hu, Zhensheng Zhao, Zhaolin Li, and Mingyu Che *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 8-13 refs Transl. into ENGLISH from Guangxue Xuebao [Acta Optica Sinica] (Shanghai, China), v. 5, no. 10, Oct. 1985 p 881-885 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

Long-term stable operations of XeCl excimer lasers depend considerably on the depletion of HCl. Experiments have shown that the lifetime of such device can be extended significantly by adding appropriate amount of an inexpensive donor gas HCl into the laser chamber made of epoxy resin pipe. In this way, more than 1.03 x one million pulses were obtained by one filling of Xe and Ar and then replenishing HCl at several appropriate times. For a repetition rate of 5.3 pulses per second and single-pulse energy of 100 mJ, the laser was still able to operate normally after working continuously for 54 hours. The maximum single-pulse energy of the laser was 160 mJ. The influence of the content of HCl on the output characteristics of the laser was also studied. Author

**N86-22744#** Joint Publications Research Service, Arlington, Va.
**THE 1.36J OUTPUT OBTAINED FROM XeCl EXCIMER LASER** **c36**
Xusan Cheng, Qihong Lou, and Runwen Wang *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 14-20 refs Transl. into ENGLISH from Guangxue Xuebao [Acta Optica Sinica] (Shanghai, China), v. 5, no. 10, Oct. 1985 p 865-869 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

The injecting locking of a XeCl excimer laser driven by a long transmission-line pulse-forming network was achieved with an unstable optical resonator. The injection-locked output energy was 1.36J (18 MW in peak power) with a linewidth of 8.9 x 0.001 A and a beam divergence of 0.2 m rad. Parameters of the injection locking and synchronization characteristics of discharge are also discussed. Author

**N86-22745#** Joint Publications Research Service, Arlington, Va.
**VELOCITY DISTRIBUTION OF ATOMIC BEAMS MEASURED** **c72**
Yuzhu Wang, Yudan Cheng, Shanyu Zhou, Weigang Huang, and Liang Liu *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 21-25 refs Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 11, 20 Nov. 1985 p 658-660 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

Measurement of the velocity distribution in an atomic beam by means of atomic beam deflection under resonance light pressure is reported. Both theoretical analysis and experimental results are given. Author

**N86-22746#** Joint Publications Research Service, Arlington, Va.
**PROGRESS IN PLASMA FOCUS RESEARCH** **c75**
Jinji Yang and Min Han *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 39-51 refs Transl. into ENGLISH from He Kexue Yu Gongcheng (Beijing, China), v. 5, no. 2, Jun. 1985 p 165-173 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

Progress in plasma focus research is discussed. Plasma focus devices, plasma focus discharge processes, neutron emission scaling laws, and recommendations for further research are discussed. R.J.F.

**N86-22747#** Joint Publications Research Service, Arlington, Va.
**SCREEN EDITING PROGRAM IN CHINESE** **c61**
Miaoping Mei *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 52-56 Transl. into ENGLISH from Xiaoxing Weixing Jisuanji Xitong (Shenyang, China), no. 2, 8 Feb. 1985 p 60-62 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

An existing Chinese on-screen editing program which is used in the C-10SP Chinese system on CROMEMCO, as well as on intelligent Chinese terminals is discussed. The on-screen editing program SCREEN supported by CDOS was modified to become an on-screen editing program in Chinese. All its capabilities were maintained. R.J.F.

**N86-22748#** Joint Publications Research Service, Arlington, Va.
**CHINA REPORT: SCIENCE AND TECHNOLOGY**
27 Jan. 1986 144 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-003) Avail: NTIS HC A07/MF A01

This journal is divided into four areas of concern to the Chinese scientific community. They are: (1) national developments; (2) applied sciences; (3) physical sciences; and (4) astronautics and nuclear electronics. Many articles under these general topics are presented. For individual titles, see N86-22749 through N86-22763.

**N86-22749#** Joint Publications Research Service, Arlington, Va.
**SIMPLE METHOD TO CONSTRUCT CUBIC SPLINE FUNCTION DESCRIBED** **c64**
Fuqi Tan *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 52-58 refs Transl. into ENGLISH from Yingyong Shuxue He Lixue (Chongqing, China), v. 6, no. 6, Jun. 1985 p 567-472 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

A simple method to construct the cubic spline function is presented. In addition, relevant problems are discussed. Finally, various treatments for different situations are introduced. Author

**N86-22750#** Joint Publications Research Service, Arlington, Va.
**MODEL FOR BOUNDARY INTEGRAL EQUATION IN SOLID MECHANICS** **c64**
Xingfeng Wang and Xingfa Wang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 59-70 refs Transl. into ENGLISH from Yingyong Shuxue He Lixue (Chongqing, China), v. 6, no. 6, Jun. 1985 p 531-540 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

A computational model for boundary integral equations in solid mechanics is established. This model is used to calculate two solid mechanics problems. The significance of the delta function structure is used in the basic solution of the Dirichlet or Neumann problems to obtain a singular integral equation through Green equation. Based on that, this basic solution satisfies the Liepshi alpha exponent condition on the boundary, this singular integral equation is expanded to the practical stage. The boundary integral

of a biharmonic equation and a Navier equilibrium equation is presented. In addition, the stress expression in this computation model is also derived. Author

**N86-22751#** Joint Publications Research Service, Arlington, Va.
**PASSIVE LOCATION, TRACKING FOR MOVING EMITTERS** **c32**

Zhongkang Sun and Peng Zhang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 71-79 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 13, no. 2, Mar. 1985 p 74-79 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

Passive location and tracking method using multiple measuring stations is discussed for a moving target carrying an active emitter. Weighted least square estimation for target location and Kalman filtering for tracking and prediction are used in such a passive location system. Simulation results show that it is an efficient method for emitter location. The location accuracy depends on the number, measuring accuracy and geometry of the stations and the moving emitter trajectories. Author

**N86-22752#** Joint Publications Research Service, Arlington, Va.
**OPTIMAL SELECTION OF PRODUCTION PLAN, SOFTWARE DESIGN** **c61**

Fu Fan *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 80-88 refs Transl. into ENGLISH from Zidonghua Xuebao (Beijing, China), v. 11, no. 1, Jan. 1985 p 87-93 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

An actual example of applying a microcomputer to production management is introduced. The method to solve the problem and the software are discussed. The economic benefit of this software is expanding year after year. Author

**N86-22753#** Joint Publications Research Service, Arlington, Va.
**COMPUTER-AIDED DESIGN OF OPTIMUM LINEAR CONTROL SYSTEMS** **c61**

Qinyou Wang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 89-96 refs Transl. into ENGLISH from Zidonghua Xuebao (Beijing, China), v. 11, no. 1, Jan. 1985 p 38-43 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

A computer aided design method for optimum linear time-invariant systems satisfying both quadratic performance index and time-domain performance index is described. The function of the CAD package and the algorithm of spectral factoring to solve for the optimum system are presented. An actual example of the design has shown that the design method performs well. Author

**N86-22754#** Joint Publications Research Service, Arlington, Va.
**GEOMETRIC NONLINEAR ANALYSIS OF SHELLS** **c61**

Di Zhang and Zhongxiong Cai *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 97-111 refs Transl. into ENGLISH from Shuzhi Jisuan Yu Jisuanji Yingyong (Beijing, China), v. 6, no. 3, Sep. 1985 p 176-187 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

The finite element method has many advantages when used in geometric nonlinear analysis and is a very effective tool for resolving complicated structures. Oblate shell elements are used as representatives to produce geometric nonlinear stiff matrix formulae that do not rely on the interpolation function of a particular element, as well as methods for writing routines. This allows originally complex calculations to become rather more convenient. Finally, numerical results for a flattened cylinder and for an oblate spheroid are provided. Author

**N86-22755#** Joint Publications Research Service, Arlington, Va.
**HOLOGRAPHIC NDT OF THIN TITANIUM PLATE DESCRIBED** **c35**

Ruixiang Yang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 112-117 refs Transl. into ENGLISH from Xiyou Jinshu (Beijing, China), v. 9, no. 4, Jul. 1985 p 58-61 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

Holography is a technique for recording the amplitude and phase changes of an object on a photographic plate in the form of interference fringes. Because the holographic interference method can examine a component in the noncontact mode and is not bothered by complicated part shape or surface roughness, it has been widely used in nondestructive testing. In the rapidly developing aerospace industry, titanium and titanium alloy thin plates are used more and more but local delamination has been found in the production process of bonded titanium plates. Using ultrasonic methods, such defects are difficult to detect and large area delaminations with tightly closed edges can easily be missed. Other testing methods are also unsuccessful. A holographic method was developed for detecting defects in thin titanium plates and several high temperature alloy plates were tested. The testing equipment, methods and results are discussed. Author

**N86-22756#** Joint Publications Research Service, Arlington, Va.
**RING DEFECT OF GaAs STUDIED** **c76**

Jianbang Chen and Guoli Zhang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 118-122 Transl. into ENGLISH from Xiyou Jinshu (Beijing, China), v. 9, no. 4, Jul. 1985 p 21-23 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

Common defects in GaAs are dislocations, stacking faults, and precipitates. Etching with molten KOH often reveals the dislocation pits, and the number of dislocation pits is generally used as an indicator of the defect density of the single crystal. Recently, circular defects were observed in chemically etched Si-doped GaAs single crystals grown in a horizontal boat. Some of these circular defects have an indented central part and resemble the shape of lunar mountains. They are ring defects. The detection method of ring defects and the results of electron probe analysis are described in detail. Author

**N86-22757#** Joint Publications Research Service, Arlington, Va.
**DESIGN OF NEW SYSTEM ARCHITECTURE WITH HYBRID REDUNDANCY (HCC)** **c60**

Tongzhao Chen *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 123-131 refs Transl. into ENGLISH from Jisuanji Xuebao (Beijing, China), v. 8, Jul. 1985 p 314-320 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

The current computer structure with hybrid redundancy (HCS) is analyzed and its problems are identified. A new hybrid redundancy system structure (HCC) is introduced. Compared to HCS, HCC recovers much more rapidly from failure. It can reuse modules cut off due to transient failure and thus becomes more reliable, neat in design, concise and easy to expand. Author

**N86-22758#** Joint Publications Research Service, Arlington, Va.
**APPLICATION OF ADAPTIVE SEGMENTATION TO SIGNAL ANALYSIS IN UNDERWATER ACOUSTICS Abstract Only** **c71**

Guoqing Wu *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 133 Transl. into ENGLISH from Yingyong Shengxue (Beijing, China), v. 4, no. 4, Oct. 1985 p 23-32 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

The Generalized Likelihood Rati (GLR) segmentation technique is applied to the analysis of underwater echo signals. Many desirable results are obtained. This indicates the applicability of the GLR segmentation technique in processing signals obscured by noise. Analytical results of two kinds of signals are presented: echo waves from an island and from a submerged object. These signals are obscured by strong noises; some signals are undetectable by human ears. However, this segmentation technique is capable of detecting the signal boundary and determining the boundary position. The result shows the prospects of the linear prediction technique applied in processing underwater acoustic signals. Seven figures show the detection of single boundary, short

segment test, power change test, segmentation in noise, detection of signal boundary of island echo waves, echo from immersing target, and weak echo from immersing target. Author

**N86-22759#** Joint Publications Research Service, Arlington, Va.
**APPLICATION OF CLASS-D POWER AMPLIFIER IN UNDERWATER SOUND PROJECTOR Abstract Only** **c71**
Enping Sun *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 134 Transl. into ENGLISH from Yingyong Shengxue (Beijing, China), v. 4, no. 4, Oct. 1985 p 42; 43-44 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

In order to reduce energy consumption (power) and raise the operating efficiency of the underwater sound projector by emitting relatively high power with the use of small transistors, it is more desirable to use a transistorized class-D power amplifier. Sufficient proof has been gained in applications. Basic circuit characteristics are presented as is a test method using circuits as examples. The class-D power amplifier uses a transistor as an on-and-off switch. The transistor operates in the saturation and interruption zones of the volt-ampere characteristic curve. Since the saturated voltage drop of the transistor is quite low, this phenomenon reduces the transistor power consumption to a minimum and raises the energy conversion efficiency of the amplifier. Three figures show electrical principle of power surge stage and power amplification stage of an underwater acoustic signal transmitter, matching network of a transducer, and electrical principle of power testing. Author

**N86-22760#** Joint Publications Research Service, Arlington, Va.
**STUDY OF PREDICTION OF LIQUID FUEL CAPTURE BY FLAMEHOLDER DOWNSTREAM OF PLAIN ORIFICE INJECTOR UNDER UNIFORM CROSS AIR FLOW Abstract Only** **c28**
Junyong Zhu, Rushan Jin, and Minghua Cao *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 136 Transl. into ENGLISH from Yuhang Xuebao (Beijing, China), no. 4, 31 Oct. 1985 p 8-15 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

Based on the flat-fan spray model and fuel capture model proposed previously, liquid fuel spray captured by the V-gutter flameholder can be predicted. The study reported in the present paper includes: (1) the effect of different factors, such as air flow parameters, injector pressure drop and the distance between the V-gutter and injector on fuel spray capture by a horizontally positioned flameholder in a wide range of parameters; (2) a comparison between the fuel spray capture by horizontally and vertically positioned flameholders; (3) the fuel spray capture by a V-gutter flameholder positioned between horizontal and vertical installation; (4) fuel spray capture by a V-gutter from an injector which has been positioned with partially contra-sream injection; and (5) the correlation for maximum fuel spray capture is obtained. Analysis indicates that the installation angle of the V-gutter and partial contra-stream injection angle are two important design variables in controlling the fuel spray capture. Author

**N86-22761#** Joint Publications Research Service, Arlington, Va.
**A STUDY OF THE FRACTURE OF CARBON-CARBON COMPOSITES Abstract Only** **c24**
Jiaxiang Zhao *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 137 Transl. into ENGLISH from Yuhang Xuebao (Beijing, China), no. 4, 31 Oct. 1985 p 40-48 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

The effect of testing parameters on the values of the work-of-fracture of carbon-carbon composites is studied, and the testing parameters for measuring the work-of-fracture of carbon-carbon composites are determined. The work-of-fracture of three different kinds of carbon-carbon composites (3D orthogonal fine woven carbon-carbon composite, carbon felt reinforced by carbon fibers carbon-carbon composite and semi-random chopped fibers carbon-carbon composite) is measured and compared with those of graphites, glassy carbons, glass and fused SiO2. The characteristic features of fracture for the different carbon-carbon composites are studied and the fracture modes and propgation of cracks as well as the weak links are pointed out. Author

**N86-22762#** Joint Publications Research Service, Arlington, Va.
**A FAST LEADING-EDGE PULSE GENERATOR Abstract Only** **c33**
Rendao Wang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 139 Transl. into ENGLISH from Hedianzixue Yu Tance Jishu (Beijing, China), v. 5, no. 5, Sep. 1985 p 294-297 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

The pulse generator consists of ECL semiconductor integrated circuits, high speed transistors and step restorer diodes, among others; its circuitry is simple. The leading edge of the output pulse is less than 100 ps, and the output impedance is 50 ohms. An ECL four-wire receiver connected as a closed loop circut is used in the oscillator section of the set. The pulse frequency varies as low as 10 Hz and as high as 100 MHz. The control of pulse with is based on the subtraction of two pulse widths. The output pulse width may be less than 10 ns and the maximum width may be as wide as an oscillator half cycle. The pulse amplitude is continuously adjustable from + or - 35 mV to + or - 5 V. The operating principle of the oscillator stage, a simplified logic diagram, waveforms at various points, a rectifier circuit in the first stage, positive pulse channel circuit, and an adjustable power source are shown. Author

**N86-22763#** Joint Publications Research Service, Arlington, Va.
**TYPE GDB-110 LARGE AREA, FAST RESPONSE PHOTOMULTIPLIER Abstract Only** **c33**
Yonglu Song, Deqi Xu, Biao Yu, and Shou Li *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 140 Transl. into ENGLISH from Hedianzixue Yu Tace Jishu (Beijing, China), v. 5, no. 5, Sep. 1985 p 303-306 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

The model GDB-110 photomultiplier is a tube with an hyperbolic terminal window and a semitransparent bialkali photocathode. The effective cathode diameter is 110 mm; borosilicate glass is used for the window. The optical spectral region is 320 to 650 nm. the photomultiplier has high detection efficiency, high response speed, and large increments. The voltage divider of model GDB-110 is designed to meet performance and use requirements; it includes model A and B voltage dividers as is shown. During detection, whether scintillation or Cerenkov radiation, the radiation intensity is very low. Therefore, only by increasing the photocathode area can the collection efficieny be improved. The model GDB-110 is adaptable to the above-mentioned situation. The outside dimensions of the photomultiplier, the relationship between anode luminosity sensitivity and operating voltage, and between time and voltage, single electron spectrum and noise spectrum; and the relationship between the secondary emission coefficient and interpole voltage are shown. Author

**N86-22764#** Joint Publications Research Service, Arlington, Va.
**JAPAN REPORT: SCIENCE AND TECHNOLOGY**
18 Mar. 1986 57 p refs Transl. into ENGLISH from various Japanese articles
(JPRS-JST-86-006) Avail: NTIS HC A04/MF A01

Progress in science and technology in Japan is reported. Topics discussed include: biotechnology, and energy. For individual titles, see N86-22765 through N86-22766.

**N86-22765#** Joint Publications Research Service, Arlington, Va.
**DESIGNING OF BIOPOLYMERS DISCUSSED** **c27**
Tatsuo Oci *In its* Japan Report: Science and Technology (JPRS-JST-86-006) 18 Mar. 1986 p 35-47 refs Transl. into ENGLISH from Bio Industry (Tokyo, Japan), Sep. 1985 p 41-49 (For primary document see N86-22764 13-31)
Avail: NTIS HC A04/MF A01

The properties and structural principles of configuration of the biopolymers are described. Of the representative biopolymers,

nucleic acids and proteins, proteins have diverse and varied functions and structures. The present state of knowledge regarding the process of biosynthesis, the formation of a three-dimensional configuration following peptide chain synthesis, and the three-dimensional structure of a protein, and what sort of designing is feasible based on that knowledge are discussed. E.A.K.

**N86-22766#** Joint Publications Research Service, Arlington, Va.
**DIRECTIONS OF TECHNOLOGICAL DEVELOPMENT BY ELECTRIC INDUSTRY** **c33**
Keiji Narimatsu *In its* Japan Report: Science and Technology (JPRS-JST-86-006) 18 Mar. 1986 p 47-54 Transl. into ENGLISH from Enerugi Foramu (Tokyo, Japan) Jul. 1985 p 84-87 (For primary document see N86-22764 13-31)
Avail: NTIS HC A04/MF A01

The electric power industry in Japan, a resources poor country, has stepped up the development of alternative energies for oil, including the utilization of atomic power technology and energy saving. Moreover, while the prospect of technology to utilize natural energies such as sunlight and wind power has increased in probability, the energy situation and economic conditions have greatly changed. Strategies are formulated to meet the demands, secure security of energy, and decide on which technology to develop. E.A.K.

**N86-22767#** Joint Publications Research Service, Arlington, Va.
**CHINA REPORT: SCIENCE AND TECHNOLOGY**
19 Mar. 1986 169 p refs Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-010) Avail: NTIS HC A08/MF A01

Progress in science and technology is highlighted in this China report. Specific topics discussed include: national developments; applied sciences; environmental quality publications and lasers. For individual titles, see N86-22768 through N86-22776.

**N86-22768#** Joint Publications Research Service, Arlington, Va.
**EMISSION MECHANISM OF OXIDE CATHODE** **c33**
Enqui Zhang *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 63-73 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 2, no. 2, Mar. 1983 p 33-39 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

The energy levels of single crystal BaO, SrO and CaO measured from thermal electrical conductivity, photoelectric conductivity, photoelectron emission and absorption spectra are so diverse that accurate energy band diagrams cannot be obtained. This suggests that the surface energy levels are more important than the bulk levels. The work function of single crystal BaO film on Ir(100) is single-valued. This is inconsistent with the wide distribution of total work function of carbonate measured by a low energy scanning electron probe, indicating that the semiconductor model cannot be used to accurately describe the oxide cathode. It was found that the coating was richer in oxygen than alkaline earth metal after 2000 hours by Auger electron spectroscopy. However, the capability to emit electrons was not affected. Thus, the oxygen vacancy donor concept is invalidated. The fact that excess barium are electron emission sources can be reconciled with decreasing alkaline earth metals during life by the dynamic surface emission center model. This model suggests that an aggregate of alkaline earth metal oxide molecules with excess absorbed bariumn atoms can effectively emit electrons. This concept can be used to interpret many phenomena observed on oxide cathodes using modern surface analysis techniques. Author

**N86-22769#** Joint Publications Research Service, Arlington, Va.
**THEORY, CALCULATION OF LARGE SIGNAL CUT-OFF ZONE IBCFA** **c32**
Ping Zhou and Keqian Zhang *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 74-85 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 2, no. 2, Mar. 1983 p 45-51 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

In a high gain injected beam cross field amplifier, the presence of a cut-off zone in the slow wave system is unavoidable. In this work, a physical model describing the drift process of a density modulated electron beam through the cut-off and the re-excitation of the slow wave by the high frequency field after the cut-off was introduced. The mathematical derivation and theoretical formulas are presented and a FORTRAN program was compiled. The results show that its error relative to experimental values is 7 to 20 percent. The length and position of the cut-off and the effect of electron drift in the cut-off on the power output were revealed by a series of calculations. The technique and program used in this work can be applied in CAD of IBCFA. Author

**N86-22770#** Joint Publications Research Service, Arlington, Va.
**NEW PLA, ITS OPTIMIZATION ALGORITHM FOR COMPUTER-AIDED DESIGN** **c60**
Chunhe Liu *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 86-98 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 11, no. 4, Jul. 1983 p 52-60 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

This paper presents a new type of PLA (R-PLA) which is made up of AND-EXCLUSIVE-OR arrays. The multi-channel digital networks described by vector Boolean algebra and the adders with parity check and parity prediction are realized very conveniently by using the R-PLA. The R-PLA is also simple for generating test codes of Boolean difference. This paper provides CAD algorithms for finding optimal or near-optimal ring sum cover. Author

**N86-22771#** Joint Publications Research Service, Arlington, Va.
**ACCURATE COMPUTER-AIDED DESIGN OF MMIC BROAD-BAND FET AMPLIFIERS** **c61**
Yongshi Wu and Herbert J. Carlin (Cornell Univ., Ithaca, N.Y.) *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 99-111 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 11, no. 4, Jul. 1983 p 76-84 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

A computer-aided design procedure applicable to low-noise and broad-band MMIC FET, amplifiers is presented. The method takes into account the non-unilateral behavior of the FET, losses in the matching networks and complex termination mismatches. The design procedure is more complete and accurate than currently available CAD methods. Two design examples, an 8 approx. 12 GHz and a 6 approx. 15GHz MMIC FET amplifier, are presented to illustrate the applications. Author

**N86-22772#** Joint Publications Research Service, Arlington, Va.
**ELECTROSTATIC LENS OF NEW TYPE FIELD EMISSION GUN** **c32**
Yushan Tu *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 112-116 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 12, no. 1, Jan. 1984 p 119-121 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

The construction and calculation results of a hyperboloidal field of unipotential electrostatic lens with low spherical aberration is presented, by which the performance of the electron optical system of the field emission gun can be easily improved. Author

**N86-22773#** Joint Publications Research Service, Arlington, Va.
**TRENDS IN DEVELOPMENT OF ELECTRON OPTICS** **c74**
Jiye Ximen *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 117-128 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 12, no. 2, Mar. 1984 p 90-96 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

The main trends in the development of electron optics are discussed. The following are noteworthy: rotationally symmetrical electron optics for the weak narrow electron beam, electron optical matrix algebra and optimization design, non-rotationally symmetrical multipole systems, the progress of scanning electron beam systems--a combined focusing deflection system, electron optics

for the wide electron beam, electron and ion optical systems with a curvilinear axis, wave electron optics. The future development and applications of electron optics have also been outlined. Electron optics is a scientific field that studies the laws of electrons in focusing, image formation, and deflection in electromagnetic fields. Using classical dynamics, classical electrodynamics, and optics as the theoretical foundation and relying on the similarities between the movement of electrons and ions in electromagnetic fields and the propagation rays in optical media, adopting optics-like methods and concepts (such as variation principle, aberration function, refractivity, rays, lenses and aberration) people have established a complete theoretical system of electron optics to study and explain these laws. Author

**N86-22774#** Joint Publications Research Service, Arlington, Va.
**CALCULATING INTERCONTINENTAL VEHICLE RANGE, ACCURACY** **c13**
Yongfang Cai *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 129-133 refs Transl. into ENGLISH from Shuxue de Shijian yu Renshi (Beijing, China), no. 3, Jul. 1985 p 1-4 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

This articles provides a simplified means to calculate the range and accuracy of intercontinental rockets as well as working out the range and accuracy of China's first intercontinental rocket. Author

**N86-22775#** Joint Publications Research Service, Arlington, Va.
**FUZZY INFERENCE SYSTEM TO DIAGNOSE AIRCRAFT HYDRAULIC FAULTS** **c01**
Shoupai Feng, Weigang Weng, and Liang Dong *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 134-141 refs Transl. into ENGLISH from Shuxue de Shijian yu Renshi (Beijing, China), no. 3, Jul. 1985 p 14-18 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

Aircraft hydraulic systems, the drive systems which control attitude, extension and retraction of landing gear, and wing flaps, are composed of tens to over a hundred parts. These systems are complex and often give rise to puzzling faults. The application of computers in fault diagnosis can increase precision and speed so as to conveniently array the prerequisites which create the fault. This is one effective way to improve the quality of aircraft maintenance. The causes of system faults and the appearance of symptoms have a random or Fuzzy nature. In the process of diagnosis the language people use is also largely vague. Based on these statistics combined with fault mechanism analysis, this article takes natural languages and transforms it into machine language and crystallize human experience to simulate a Fuzzy inference system. The characteristic nature of the system is first to select from events a set of symptoms (input) and causes (output) of model fault events and store them in a computer. Then during diagnosis an input works in this system to diagnose the causes (output). B.W.

**N86-22776#** Joint Publications Research Service, Arlington, Va.
**INVESTIGATION OF COLLIDING-MODE Nd:YAG LASER** **c36**
Xing Lin, Wenzhen Zhang, Huiming Zhuang, and Fengtie Wu *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 142-148 refs Transl. into ENGLISH from Guangxue Xuebao (Shanghai, China), v. 5, no. 9, Sep. 1985 p 794-798 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

The cavity configuration of a colliding-pulse mode-locked Nd:YAG laser is described. A stable mode-locked pulse train was observed with a 500-MHz oscilloscope; the average pulse width was about 10 ps. The relationship of the dye concentration to the mode locking threshold was studied in detail and mode-locked multiple pulses were shown to appear as the pumping energy was increased. Author

# 32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

**N86-22777** British Broadcasting Corp., Kingswood (England). Engineering Div.
**THE SUBJECTIVE EFFECTS OF RANDOM BIT ERRORS IN YUV COMPONENT VIDEO SIGNALS**
K. R. Slavin Dec. 1985 12 p refs
(BBC-RD-1985/17) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, Engl.

This Report describes two sets of subjective test measurements of error visibility on pictures derived from digital YUV video signals sampled in compliance with CCIR Recommendation 601. The first set of tests measured the subjective picture impairment resulting from random, single-bit errors in either the luminance (Y) or chrominance (U/V) channels. The second set of tests measured the impairment in chroma-key performance produced by errors in the U or V components. The results show that one random single bit error per second in the most significant bit (MSB) of the Y channel is just perceptible, and 10 per second in the MSB of the U/V channel. In the chroma-key tests, errors in the MSB of both U and V were just perceptible at 3 per second, and in addition, errors in the lower bit significances of the U channel were more visible than the V channel. Author

**N86-22778** British Broadcasting Corp., Kingswood (England). Engineering Div.
**SIGNALLING IN PARITY: A BRIEF HISTORY**
J. P. Chambers Dec. 1985 16 p refs
(BBC-RD-1985/15) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, Engl.

Equipment built in British Broadcasting Company (BBC) Engineering Research Department in 1974 for use on an experimental 120 Mbits/s digital link required no additional signalling capacity for multiplex control and synchronization. The general technique of signalling in parity as used in that equipment and how it has found other applications over the last ten years in synchronization, control and robust transmission of auxiliary data are described. The technique features in several new services such as the Radio-Data System (RDS), digital stereo sound for television (DSSTV) and the sound multiplex of the C-MAC/packet system for direct broadcasting by satellite. Author

**N86-22779** British Broadcasting Corp., Kingswood (England). Engineering Div.
**DIGITAL CODING RANGES FOR USE IN AN ALL-DIGITAL SOUND-STUDIO COMPLEX**
W. I. Manson Dec. 1985 10 p refs
(BBC-RD-1985/16) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, Engl.

The sound-signal coding-range requirements for different applications in digital studio complex, excluding the internal requirements of processing equipment are considered. It is suggested that the most demanding requirements should be met by a coding standard of 22 bits/sample for uncontrolled sound signals. At the output of the studio center, when no further processing of the signal is envisaged, the coding may be reduced to 16 bits/sample, or to 14 bits/sample with the aid of digital limiting for distribution. It is noted that 22 bits/sample linear coding is well beyond the capability of present analogue/digital converter technology, however, floating-point converters approaching this standard would be adequate. It is noted that the floating point techniques may have further application in digital recording, to provide equivalent wide-dynamic-range recording facilities. E.A.K.

**N86-22780** Department of the Air Force, Washington, D.C.
**BISTATIC PULSE-OVERLAP DOPPLER RADAR INTRUSION DETECTION APPARATUS** **Patent**

Bryan L. Burns and Michael W. Callahan, inventors (to Air Force) Issued 10 Sep. 1985 6 p Supersedes AD-D010087 (AD-D012011; US-Patent-4,540,978; US-Patent-Appl-SN-447736; US-Patent-Class-340-554) Avail: US Patent and Trademark Office CSCL 17/5

An intrusion detection apparatus utilizing an array of bistatic pulse-overlap Doppler radar units to detect target Doppler frequency shifts is an enclosed sensitive volume and utilizing a single RF frequency with different pulse repetition rates to synchronize the bistatic receiver unit with its associated transmitter unit. Author (GRA)

**N86-22781#** Royal Signals and Radar Establishment, Malvern (England).

**AN INVESTIGATION OF SYNTHETIC APERTURE RADAR AUTOFOCUS**

I. P. Finley and J. W. Wood Apr. 1985 44 p refs (RSRE-MEMO-3790; BR97350) Avail: NTIS HC A03/MF A01

The principles of SAR and the requirement for an autofocus system are discussed. Three autofocus methods are investigated: measurement of the power spectrum, constrast maximization, and registration of multilook images. The power spectrum is shown to be unreliable as an autofocus aid. Results of the contrast maximization and registration methods are compared, and show that both methods are suitable. Author (ESA)

**N86-22782*#** Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering and Applied Physics.

**MUTUAL COUPLING EFFECTS IN ANTENNA ARRAYS, VOLUME 1 Final Technical Report, 15 May 1982 - 31 Mar. 1986**

R. E. Collin Mar. 1986 178 p refs (Grant NAG3-291) (NASA-CR-176699; NAS 1.26:176699; WGR-86-4-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 20N

Mutual coupling between rectangular apertures in a finite antenna array, in an infinite ground plane, is analyzed using the vector potential approach. The method of moments is used to solve the equations that result from setting the tangential magnetic fields across each aperture equal. The approximation uses a set of vector potential model functions to solve for equivalent magnetic currents. A computer program was written to carry out this analysis and the resulting currents were used to determine the co- and cross-polarized far zone radiation patterns. Numerical results for various arrays using several modes in the approximation are presented. Results for one and two aperture arrays are compared against published data to check on the agreement of this model with previous work. Computer derived results are also compared against experimental results to test the accuracy of the model. These tests of the accuracy of the program showed that it yields valid data. Author

**N86-22783*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**A NOVEL METHOD OF CALCULATING FAR-FIELD PATTERNS OF LARGE APERTURE ANTENNAS**

M. C. Bailey Mar. 1986 39 p (NASA-TM-87644; NAS 1.15:87644 Avail: NTIS HC A03/MF A01 CSCL 20N

A method is described for calculation of the radiation pattern of large aperture antennas. A piece-wise linear approximation of the aperture field using overlapping pyramidal basis functions allows the radiation pattern of an aperture antenna to be calculated as though it were a two-dimensional array. The calculation of radiation pattern data versus theta and phi, suitable for 3-D or contour plot algorithms, is achieved by locating the array in the yz-plane and performing a summation over the aperture field data sampled on a square grid. A FORTRAN subroutine is provided for performing radiation pattern calculations. Numerical results are included to demonstrate the accuracy and convergence of the method. These numerical results indicate that typical accuracies of + or - 0.1 dB for Directivity, + or - dB for the 1st Sidelobe Level, and + - 2dB for the 2nd Sidelobe Level can be obtained with an aperture grid of 45x45 points and requires approximately 0.02 seconds CPU time per far-field data point on a VAX 11/750 with a floating point accelerator. Author

**N86-22784*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**THE TELECOMMUNICATIONS AND DATA ACQUISITION REPORT Progress Report, Oct. - Dec. 1985**

E. C. Posner, ed. 15 Feb. 1986 275 p refs (Contract NAS7-918) (NASA-CR-176691; JPL-TDA-PR-42-84; NAS 1.26:176691) Avail: NTIS HC A12/MF A01 CSCL 17B

Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is documented. In addition, developments in Earth-based radio technology as applied to geodynamics, astrophysics and the radio search for extraterrestrial intelligence are reported. For individual titles, see N86-22785 through N86-22809.

**N86-22785*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**THE EFFECT OF THE DYNAMIC WET TROPOSPHERE ON VLBI MEASUREMENTS**

R. N. Treuhaft and G. E. Lanyi *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 1-17 refs (For primary document see N86-22784 13-32) Avail: NTIS HC A12/MF A01 CSCL 20N

Calculations using a statistical model of water vapor fluctuations yield the effect of the dynamic wet troposphere on Very Long Baseline Interferometry (VLBI) measurements. The statistical model arises from two primary assumptions: (1) the spatial structure of refractivity fluctuations can be closely approximated by elementary (Kolmogorov) turbulence theory, and (2) temporal fluctuations are caused by spatial patterns which are moved over a site by the wind. The consequences of these assumptions are outlined for the VLBI delay and delay rate observables. For example, wet troposphere induced rms delays for Deep Space Network (DSN) VLBI at 20-deg elevation are about 3 cm of delay per observation, which is smaller, on the average, than other known error sources in the current DSN VLBI data set. At 20-deg elevation for 200-s time intervals, water vapor induces approximately 1.5 x 10 to the minus 13th power s/s in the Allan standard deviation of interferometric delay, which is a measure of the delay rate observable error. In contrast to the delay error, the delay rate measurement error is dominated by water vapor fluctuations. Water vapor induced VLBI parameter errors and correlations are calculated. For the DSN, baseline length parameter errors due to water vapor fluctuations are in the range of 3 to 5 cm. The above physical assumptions also lead to a method for including the water vapor fluctuations in the parameter estimation procedure, which is used to extract baseline and source information from the VLBI observables. Author

**N86-22786*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**NEW REFLECTIVE SYMMETRY DESIGN CAPABILITY IN THE JPL-IDEAS STRUCTURE OPTIMIZATION PROGRAM**

D. Strain and R. Levy *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 18-25 refs (For primary document see N86-22784 13-32) Avail: NTIS HC A12/MF A01 CSCL 20N

The JPL-IDEAS antenna structure analysis and design optimization computer program was modified to process half structure models of symmetric structures subjected to arbitrary external static loads, synthesize the performance, and optimize the design of the full structure. Significant savings in computation time and cost (more than 50%) were achieved compared to the cost of full model computer runs. The addition of the new reflective symmetry analysis design capabilities to the IDEAS program allows processing of structure models whose size would otherwise prevent automated design optimization. The new program produced synthesized full model iterative design results identical to those of actual full model

program executions at substantially reduced cost, time, and computer storage. Author

**N86-22787*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**PRELIMINARY RESULTS TOWARD INJECTION LOCKING OF AN INCOHERENT LASER ARRAY** **c36**

James Daher *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 26-34 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 20E

The preliminary results of phase locking an incoherent laser array to a master source in an attempt to achieve coherent operation are presented. The techniques necessary to demonstrate phase locking are described along with some topics for future consideration. As expected, the results obtained suggest that injection locking of an array, where the spacing between adjacent longitudinal modes of its elements is significantly larger than the locking bandwidth, may not be feasible. Author

**N86-22788*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**LOW-LOSS OFF-AXIS FEEDS FOR SYMMETRIC DUAL-REFLECTOR ANTENNAS**

T. Veruttipong, V. Galindo-Israel, and W. Imbriale *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 35-59 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 20N

Circularly symmetric, dual reflector, high gain antenna systems often require feeds placed off the system's axis because of the need for multiple feeds to use the reflector antenna. Also, the constraint requiring the hyperboloid or shaped subreflector to remain circularly symmetric is sometimes added. In a Cassegrainian system, the subreflector and feed may be rotated off axis around the paraboloid focus and retain main reflector focusing. However, substantial spillover results in considerable noise with a high gain/low noise temperature system. In a shaped system, the tilt of the shaped subreflector and feed together results in substantial defocusing as well as spillover noise. If the subreflector is tilted approximately one-half the angle of the feed tilt in either the Cassegrainian or the dual shaped reflector antenna, it is found that spillover and noise are substantially reduced with tolerable defocusing. An extensive numerical analysis of these effects was conducted to determine the characteristics of a planned 70-meter, dual shaped reflector versus Cassegrainian antenna and to gain some understanding of the cause of the observed effects. Author

**N86-22789*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**A NOTE ON THE WIDEBAND GAUSSIAN BROADCAST CHANNEL**

R. J. McEliece (California Inst. of Tech., Pasadena), E. C. Posner, and L. Swanson *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 60-65 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 17B

It is well known that for the Gaussian broadcast channel, timeshared coding is not as efficient as more sophisticated broadcast coding strategies. However, the relative advantage of broadcast coding over timeshared coding is shown to be small if the signal-to-noise ratios of both receivers are small. One surprising consequence of this is that for the wideband Gaussian broadcast channel, which is defined, broadcast coding offers no advantage over timeshared coding at all, and so timeshared coding is optimal. Author

**N86-22790*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**ON THE DECODE ERROR PROBABILITY FOR REED-SOLOMON CODES**

R. J. McEliece (California Inst. of Tech., Pasadena) and L. Swanson *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 66-72 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 17B

Upper bounds on the decoder error probability for Reed-Solomon codes are derived. By definition, decoder error occurs when the decoder finds a codeword other than the transmitted codeword; this is in contrast to decoder failure, which occurs when the decoder fails to find any codeword at all. The results imply, for example, that for a t error correcting Reed-Solomon code of length q - 1 over GF(q), if more than t errors occur, the probability of decoder error is less than 1/t!. In particular, for the Voyager Reed-Solomon code, the probability of decoder error given a word error is smaller than 3 x 10 to the minus 14th power. Thus, in a typical operating region with probability 100,000 of word error, the probability of undetected word error is about 10 to the minus 14th power. Author

**N86-22791*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**A SINGLE CHIP VLSI REED-SOLOMON DECODER** **c33**

H. M. Shao, T. K. Truong, I. S. Hsu, L. J. Deutsch, and I. S. Reed (University of Southern California) *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 73-81 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 09A

A new VLSI design of a pipeline Reed-Solomon decoder is presented. The transform decoding technique used in a previous design is replaced by a time domain algorithm. A new architecture that implements such an algorithm permits efficient pipeline processing with minimum circuitry. A systolic array is also developed to perform erasure corrections in the new design. A modified form of Euclid's algorithm is implemented by a new architecture that maintains the throughput rate with less circuitry. Such improvements result in both enhanced capability and a significant reduction in silicon area, therefore making it possible to build a pipeline (31,15)RS decoder on a single VLSI chip. Author

**N86-22792*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**EFFECTS OF QUANTIZATION ON SYMBOL STREAM COMBINING IN A CONVOLUTIONALLY CODED SYSTEM**

F. Pollara and L. Swanson *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 82-87 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 17B

Symbol stream combining has been proposed as a method for arraying signals at different antennas. If the received symbol streams are recorded on tape, it is desirable to limit the required storage without significantly affecting the performance. It is shown that 4-bit quantized symbols introduce an E sub b/N sub o penalty of only 0.05 dB. Author

**N86-22793*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**ACQUISITION TIMES OF CARRIER TRACKING SAMPLED DATA PHASE-LOCKED LOOPS**

S. Aguirre *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 88-92 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 17B

Phase acquisition times of type II and III loops typical of the Advanced Receiver are studied by computer simulations when the loops are disturbed by gaussian noise. Reliable estimates are obtained by running 5000 trials for each combination of loop signal-to-noise ratio (SNR) and frequency offset. The probabilities of acquisition are shown versus time from start of acquisition for various loop SNRs and frequency offsets. For frequency offsets smaller than one-fourth of the loop bandwidth and for loop SNRs of 10 dB and higher, the loops acquire with probability 0.99 within 2.5 B sub L for type II loops and within 7/B sub L for type III loops. Author

**N86-22794*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**PHYSICAL OPTICS ANALYSIS OF A FOUR-REFLECTOR ANTENNA, PART 1** c74

A. G. Cha *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 94-100 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 20F

Concern has been raised for the 64-m to 70-m antenna upgrade project that the 70-m system may experience greater S-band beam-pointing perturbations than the 64-m system. The S-band perturbations are due to minor (higher order) mode generation, causing subtle cross-polarization fields affecting beam pointing direction, as described herein. For the antennas in their present configuration (64 m), a slight S-band gain degradation of about 0.05 dB can be attributed to these effects. Therefore, a full physical optics analysis was performed for the present-day 64-m system, as described herein. The results were compared with past analyses and experimental observations in order to verify the algebra and computer code with the intent of deriving a valid analysis method for accurately analyzing the 70-m shaped dual reflector Cassegrainian antenna. The results of the new analysis appear to be in excellent agreement with previous analyses and experimental data. Author

**N86-22795*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**PERFORMANCE CHARACTERISTICS FOR AN ARRAY OF TWO RECEIVING SYSTEMS WITH UNEQUAL PREDETECTION SIGNAL-TO-NOISE RATIOS AND ENHANCED RADIO FREQUENCY CARRIER MARGIN IMPROVEMENT**

M. H. Brockman *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 101-111 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 17B

Enhanced radio frequency carrier margin improvement for arrayed receiving systems for coherent reception of phase modulated signals with residual carrier provides a significant reduction in carrier loop phase noise and increase in signal to noise ratio in the RF carrier tracking loop with an attendant reduction in telemetry radio loss. A significant increase in Doppler frequency rate capability is also realized relative to operating at a narrower tracking loop bandwidth to obtain the same carrier sensitivity improvement. These performance characteristics are examined for an array of two receiving systems with unequal apertures and statistically independent predetection noise. Author

**N86-22796*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**PERFORMANCE CHARACTERISTICS FOR AN ARRAY OF TWO RECEIVING SYSTEMS WITH EQUAL APERTURES AND ENHANCED RADIO FREQUENCY CARRIER MARGIN IMPROVEMENT**

M. H. Brockman *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 112-126 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 17B

Enhanced radio frequency carrier margin improvement for arrayed receiving systems for coherent reception of phase modulated signals with residual carrier provides a significant reduction in carrier loop phase noise and an increase in the signal to noise ratio in the RF carrier tracking loop with an attendant in telemetry radio loss. A significant increase in doppler frequency rate capability is also realized relative to operating at a narrower tracking loop bandwidth to obtain the same carrier sensitivity improvement. These performance characteristics are examined for an array of two receiving sysems with equal apertures and statistically independent prediction noise. Author

**N86-22797*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**A CONCEPTUAL 34-METER ANTENNA FEED CONFIGURATION FOR JOINT DSN/SETI USE FROM 1 TO 10 GHz**

S. D. Slobin *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 127-134 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 20N

The very satisfactory performance of a conceptual 34-m DSS-12 type HA-Dec antenna feed sysem over the frequency range of 1 to 10 GHz is demonstrated. A seven-feedhorn baseline design is developed which will allow Search for Extra-Terrestrial Intelligence (SETI) investigations using each horn over a 1.4:1 frequency range. A gain/system noise temperature (G/T) figure of merit is calculated for the frequency range of each horn; it is found that system performance down to 20 deg elevation is possible with a G/T degradation of less than 3 dB at every frequency. The design presented here will allow shared but independent antenna use by the Deep Space Network (DSN) and SETI with a minimum of operational impacts to DSN functions and no intrusions into the DSN microwave equipment configuration. Author

**N86-22798*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**DSN COMMAND SYSTEM MARK IV-85**

H. C. Thorman *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 135-142 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 17B

A functional description of the Deep Space Network Command System and its subsystem is presented. The DSP command system was implemented in 1986. Store and forward command functions are reviewed. Throughput command functions for Earth orbiter missions and subsystems configurations for Mark IV-85 system are summarized. Author

**N86-22799*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**DEEP SPACE NETWORK RADIO SCIENCE SYSTEM FOR VOYAGER URANUS AND GALILEO MISSIONS** c91

T. K. Peng and F. F. Donivan *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 143-151 (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 03B

An overview is presented of major new requirements, challenges and conceptual designs for the DSN Radio Science System in the 1985 to 1988 period. The Voyager Uranus encounter is being supported with larger combined aperture, higher sample rate, and a centrally controlled network. The Galileo mission will be provided with a high resolution S-Band Faraday rotation detection capability and a high-stability Doppler system with X-Band uplink for gravitational wave search. Author

**N86-22800*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**THE SEARCH FOR REFERENCE SOURCES FOR DELTA VLBI NAVIGATION OF THE GALILEO SPACECRAFT** c93

J. S. Ulvestad and R. P. Linfield *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 152-163 refs (For primary document see N86-22784 13-32)

Avail: NTIS HC A12/MF A01 CSCL 03B

A comprehensive search was made in order to identify celestial radio sources that can be used as references for navigation of the Galileo spacecraft by means of VLBI observations. The astronomical literature was seached for potential navigation sources, and several VLBI experiments were performed to determine the suitability of those sources for navigation. The results of such work performed since mid-1983 is reported. A summary is presented of the source properties required, the procedures used to identify candidate sources, and the results of the observations of these sources. The lists of souces presented are not meant to be taken directly and used for VLBI navigation, but they do provide a means of identifying the radio sources that could be used at various positions along the Galileo trajectory. Since the reference sources nearest the critical points of Jupiter encounter and probe release are rather weak, it would be extremely beneficial to use a pair of 70-m antennas for the VLBI measurements. Author

**N86-22801*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**GAIN, PHASE AND FREQUENCY STABILITY OF DSS-42 AND DSS-43 VOR VOYAGE URANUS ENCOUNTER**
A. G. Cha and R. Levy *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 164-175 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 20N

Theoretically rigorous definitions are derived of such parameters as RF signal path length, phase delay, and phase/frequency stability in a Cassegrainian antenna applicable to a narrow bandwidth channel, as well as algorithms for evaluating these parameters. This work was performed in support of the Voyager spacecraft encounter with Uranus in January 1986. The information was needed to provide Voyager/Uranus radio science researchers with a rotational basis for deciding the best strategy to operate the three antennas involved during the crucial 5-hour occultation period of the encounter. Such recommendations are made at the end of the article. Author

**N86-22802*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ICE ENCOUNTER OPERATIONS c90**
N. Fanelli and D. Morris *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 176-185 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

The operations encompassing the International Cometary Explorer's (ICE) encounter with the Comet Giacobini-Zinner on September 11, 1985 are documented. The ICE mission presented new challenges for the Deep Space Network (DSN) 64 meter subnetwork. Because of poor telemetry link margin predicted for Giacobini-Zinner (GZ) encounter, supplemental support by the Japanese Institute for Space and Astronautical Sciences 64-meter antenna at Usuda, Japan and the 305-meter Arecibo Radio Observatory in Puerto Rico was required. To improve the 64 meter subnetwork telemetry performance the following were also implemented: (1) Real time antenna array of 64 meter and 34 meter at a single complex and the required performance testing; and (2) Nonreal time antenna array of two complexes was implemented as a backup in the event of ground or spacecraft failure. Author

**N86-22803*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**USUDA DEEP SPACE CENTER SUPPORT FOR ICE c90**
J. P. Goodwin *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 186-196 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

The planning, implementation and operations that took place to enable the Usuda, Japan, Deep Space Center to support the International Cometary Explorer (ICE) mission are summarized. The results show that even on very short notification our two countries can provide mutual support to help ensure mission success. The data recovery at the Usuda Deep Space Center contributed significantly to providing the required continuity of the experimental data stream at the encounter of the Comet Giacobini-Zinner. Author

**N86-22804*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ARECIBO OBSERVATORY SUPPORT OF THE US INTERNATIONAL COMETARY EXPLORER MISSION ENCOUNTER AT COMET GIACOBINI-ZINNER c90**
D. D. Gordon and M. T. Ward (NASA. Goddard Space Flight Center) *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 197-202 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

The Arecibo Observatory in Puerto Rico participated in the support of the U.S. International Cometary Explorer (ICE) mission when the ICE spacecraft passed through the tail of comet Giacobini-Zinner on September 11, 1985. The Arecibo Observatory is a research facility of the National Astronomy and Ionosphere Center (NAIC) operated by Cornell University under contract to the National Science Foundation (NSF). Coverage of the encounter involved the use of the observatory's 305-m (1000-ft) radio reflector antenna and RF and data system equipment fabricated or modified specifically for support of the ICE mission. The successful implementation, testing, and operation of this temporary receive, record, and data relay capability resulted from a cooperative effort by personnel at the Arecibo Observatory, the Goddard Space Flight Center, and the Jet Propulsion Laboratory. Author

**N86-22805*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ICE TELEMETRY PERFORMANCE c17**
J. W. Layland *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 203-213 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 09F

Acquiring telemetry data from the International Cometary Explorer (ICE) at its encounter with the comet Giacobini-Zinner on September 11, 1985 proved to be among the more difficult challenges the DSN has met in recent years. The ICE spacecraft began its life as an Earth orbiting monitor of the Solar Wind. At the comet, ICE was nearly 50 times as distant as in its initial role, with its signal strength diminished nearly 2500 times. Collecting enough of that weak signal to provide meaningful scientific data about the comet required unique new telemetry capabilities and special handling by the DSN. This article describes the development and validation of the DSN telemetry capability for ICE from its early planning stages through the successful comet encounter. Author

**N86-22806*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PERIODIC VARIATIONS IN THE SIGNAL-TO-NOISE RATIOS OF SIGNALS RECEIVED FROM THE ICE SPACECRAFT**
T. Nadeau *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 214-219 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 20N

Data from the ICE probe to comet Giacobini-Zinner are analyzed to determine the effects of spacecraft rotation upon the signal to noise ratio (SNR) for the two channels of data. In addition, long-term variations from sources other than rotations are considered. Results include a pronounced SNR variation over a period of three seconds (one rotation) and a lesser effect over a two minute period (possibly due to the receiving antenna conscan). Author

**N86-22807*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**INTERCONTINENTAL ANTENNA ARRAYING BY SYMBOL STREAM COMBINING AT ICE GIACOBINI-ZINNER ENCOUNTER c90**
W. J. Hurd, F. Pollara, M. D. Russell, B. Siev, and P. U. Winter *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 220-228 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

Deep space tracking stations on different continents were arrayed during the encounter of the International Cometary Explorer (ICE) spacecraft with the comet Giacobini-Zinner during September 9 through 12, 1985. This is the first time that telemetry signals received on different continents have been combined to enhance signal to noise ratio. The arraying was done in non-real time using the method of symbol stream combining. The improvement in signal to noise ratio was typically 2 dB over the stronger of the two stations in each array. Author

**N86-22808*#** California Inst. of Tech., Pasadena.
**TIME AND SPACE INTEGRATING ACOUSTO-OPTIC FOLDED SPECTRUM PROCESSING FOR SETI**
K. Wagner and D. Psaltis *In* JPL The Telecommunications and

Data Acquisition Report 15 Feb. 1986 p 229-248 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 20N

Time and space integrating folded spectrum techniques utilizing acousto-optic devices (AOD) as 1-D input transducers are investigated for a potential application as wideband, high resolution, large processing gain spectrum analyzers in the search for extra-terrestrial intelligence (SETI) program. The space integrating Fourier transform performed by a lens channels the coarse spectral components diffracted from an AOD onto an array of time integrating narrowband fine resolution spectrum analyzers. The pulsing action of a laser diode samples the interferometrically detected output, aliasing the fine resolution components to baseband, as required for the subsequent charge coupled devices (CCD) processing. The raster scan mechanism incorporated into the readout of the CCD detector array is used to unfold the 2-D transform, reproducing the desired high resolution Fourier transform of the input signal. Author

**N86-22809*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**VITERBI ALGORITHM ON A HYPERCUBE: CONCURRENT FORMULATION** **c64**
F. Pllara *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 249-255 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 12A

The similarity between the Fast Fourier Transform and the Viterbi algorithm is exploited to develop a Concurrent Viterbi Algorithm suitable for a multiprocessor system interconnected as a hypercube. The proposed algorithm can efficiently decode large constraint length convolutional codes, using different degrees of parallelism, and is attractive for VLSI implementation. Author

**N86-22810** Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Research.
**TOVPIX: SOFTWARE FOR EXTRACTION AND CALIBRATION OF TOVS DATA FROM THE HIGH RESOLUTION PICTURE TRANSMISSION FROM TIROS-N SATELLITES**
D. M. OBrien 1985 44 p
(CSIRO-DAR-TP-10; ISBN-0-643-03974-0) Copyright. Avail: NTIS
Avail: Issuing Activity

Software which accepts High Resolution Picture Transmission (HRPT) service of the NOAA series of polar orbiting meteorological satellites, and extracts the data pertaining to the high Resolution Infrared Radiation Sounder (HIRS) and Microwave Sounding Unit (MSU) instruments of the TIROS Operational Vertical Sounder (TOVS) package is described. The output from the program is an impage containing the calibrated data for the 20 HIRS channels and 4 MSU channels, with the latter linearly interpolated to the HIRS spots. The output image is cast in the format for the Software for Satellite image processing (SLIP). Earth location of points on the image is accomplished by the satellite navigation package which was integrated with SLIP. The software is designed for routine application, with manual intervention only required whenever a new Satellite is launched or whenever NOAA updates the calibration parameters of the operational satellites. B.G.

**N86-22811#** European Space Agency, Paris (France).
**PROCEEDINGS OF AN INTERNATIONAL SYMPOSIUM ON SATELLITE TRANSMISSIONS**
E. J. Rolfe, comp. Nov. 1985 210 p refs Symposium held in Graz, Austria; sponsored by ESA, Austrian Solar and Space Agency, and Forschungsgesellschaft Joanneum Graz
(ESA-SP-245; ISSN-0379-6566) Avail: NTIS HC A10/MF A01

Satellite transmission systems and services; data transmission; wave propagation; and time measurement by satellites were discussed. For individual titles, see N86-22812 through N86-22835.

**N86-22812#** Technische Univ., Graz (Austria). Dept. of Communications and Wave Propagation.
**CURRENT PROBLEMS IN SATELLITE TRANSMISSION RESEARCH**
W. Riedler *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 5-11 (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

Extension of the usable RF spectrum for satellite transmissions; information transmission by satellite; and timekeeping and time transfer problems in satellite transmission are discussed. Orbit overcrowding and ground station siting are considered. Author (ESA)

**N86-22813#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**ESA'S FUTURE PLANS IN THE FIELD OF SATELLITE TELECOMMUNICATIONS**
P. Bartholome *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 15-20 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The European Space Agency's plans for applications of communications satellites for implementation in the 1990s are outlined. The most promising among these are satellites featuring multibeam phased-array antennas for maritime/aeronautical services in the Atlantic Ocean region and for land mobile services in Western Europe, satellites with on-board TST switching and multiple-bit-rate conversion capability for use in fixed services, and satellites with reconfigurable payloads for direct broadcasting and distribution to cable networks. The program comprises three phases: system definition and design, development of laboratory models as proofs of concepts, and full-scale demonstrations based on in-orbit flights. Author (ESA)

**N86-22814#** European Space Agency, Paris (France).
**THE EUTELSAT SYSTEM OF SATELLITE DATA TRANSMISSIONS**
Paul Barthmann (EUTELSAT, Paris, France) *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 21-34 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The EUTELSAT Organization and the satellites composing its space segments are presented. The Earth stations and the assumptions underlying the main characteristics are described. The possibilities offered by satellite multiservices (SMS) are indicated. Limitations of the SMS system are outlined, together with the reasons for certain choices. The approach in the link budgets and the determination of the system capacity are described and examples are given. Author (ESA)

**N86-22815#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**THE OLYMPUS SATELLITE AND ITS UTILIZATION**
C. D. Hughes *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 35-40 (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The Olympus satellite was designed to provide communication satellite technology for the 1990s. It has a lift-off mass > 2t and an in-orbit beginning of life mass of 1.5t. Olympus will carry a representative selection of payload elements needed for later operational missions to enable the components to be tested in-orbit and give the opportunity for potential service-providers to develop Earth stations and systems needed for later operational satellites. The satellite has four separate payloads on-board: direct broadcast payload; specialized services payload; 20/30 GHz communications payload, and propagation beacon package. Author (ESA)

**N86-22816#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**ADVANCED ON-BOARD PROCESSING SATELLITE SYSTEM CONCEPTS**
S. E. Dinwiddy *In its* Proceedings of International Symposium on

Satellite Transmissions Nov. 1985 p 41-46 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

Repeater systems for ESA communication satellites are described. The systems feature satellite switched TDMA to exploit multiple beams; on-board regeneration to improve TDMA time-plan efficiency; on-board bit-rate conversion to reduce Earth station transmitter power; beam hopping to serve low-traffic beams economically; and time-stages on-board to permit demand assignment. The Agency is concentrating on the development of on-board demodulators and a TST switching system. A payload with the full range of facilities to allow experimenters to run trials of simple and complex on-board-processing systems is proposed.
Author (ESA)

**N86-22817#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**EXPERIMENTAL ON-BOARD PROCESSING PAYLOAD FOR ADVANCED COMMUNICATIONS SATELLITE c60**
O. B. Millies-Lacroix *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 47-49 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

An in-orbit experiment to test demodulation, remodulation, TST switching, and beam hopping possibilities offered by multi-beam antennas and their corollaries such as frequency reuse and commutation matrices is proposed. The 20/30 GHz band would be used with FDMA initially and TDMA later to assess cost reduction for small user stations.
Author (ESA)

**N86-22818#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Data Relay Satellite Space Segment.
**THE ESA DATA RELAY SATELLITE PROGRAM c18**
D. L. Brown, K. G. Lenhart (ESOC, Darmstadt, West Germany), and M. Otter (ESOC, Darmstadt, West Germany) *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 51-56 (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

A satellite data relay system (DRS) reference concept is described and economic arguments for a DRS are presented. The reference system concept envisages a spacecraft of the Ariane/SPELDA class with a microwave payload operating at S-band, compatible with TDRSS, and at Ka-band for the high data rate services, providing services to four users simultaneously, two in each frequency band. Maximum communication capacity is 2 x 500 Mbps at Ka-band, and 2 x 5 Mbps at S-band for the LEO-DRS-ground link. The spacecraft is compatible with any position in geostationary orbit and scans up to plus or minus 10 deg about the nadir (which corresponds to being able to track LEO spacecraft out to 1000 km altitude). The spacecraft should be able to carry, in its first flight configuration, a preoperational optical communications transceiver in addition to the operational microwave payload.
Author (ESA)

**N86-22819#** European Space Agency, Paris (France). Directorate of Telecommunications.
**OPTIMIZATION TECHNIQUES IN SATELLITE TRANSMISSION DESIGN**
L. Erup and R. A. Harris *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 59-69 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

A technique for the use of numerical optimization methods in satellite transmission system design is presented. This allows system designers to concentrate on the engineering aspects of the design process, leaving many of the low-level decisions to the computer. The implementation described, which uses Powell's optimization algorithm and features of the UNIX operating system, can be used with any design program (e.g., transmission simulators). Possibilities and limitations of the method, and examples of its application are outlined.
Author (ESA)

**N86-22820#** Science Research Council, Edinburgh (Scotland). Rutherford Appleton Lab.
**THE USE OF SATELLITE CHANNELS FOR COMPUTER NETWORKING c62**
J. W. Burren *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 71-78 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

Experience gained from the experiments STELLA and Project Universe in computer networking via satellite is reviewed. In these experiments a broadcast satellite channel was used to provide wide area communication between local area networks at the sites involved. The requirements for this backbone network function are described and the effectiveness of a satellite in this role is assessed. In both experiments satellite access was gained using a minicomputer driving a satellite Earth-station via a microprocessor controller interface. Weaknesses in this design structure are outlined. A high performance controller based on the use of two microprocessor systems used in a parallel configuration, one for the uplink and one for the downlink is described. This controller uses variable rate block encoding and drives a variable rate burst modem.
Author (ESA)

**N86-22821#** Consiglio Nazionale delle Ricerche, Pisa (Italy). CNUCE Inst.
**MIXING STREAM AND DATAGRAM TRAFFIC ON SATELLITE: A FIFO ORDER-BASED DEMAND ASSIGNMENT (FODA) TIME DIVISION MULTIPLE ACCESS (TDMA) SCHEME**
R. Beltrame, A. B. Bonito, N. Celandroni, and E. Ferro *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 79-90 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

A FIFO Order based Demand Assignment (FODA) access scheme was designed to handle packetized data and voice traffic in a multiple access satellite broadcast channel of Mbits band. The channel is shared by as many as 64 simultaneously active stations in a range of 255 addressable stations. A sophisticated traffic environment is assumed, including different types of service requirements and an arbitrary load distribution among the stations. The results of 2Mbit/sec simulation tests for an existing hardware environment are presented.
Author (ESA)

**N86-22822#** Technische Univ., Graz (Austria). Dept. of Communications and Wave Propagation.
**PERFORMANCE INVESTIGATIONS FOR DIGITAL DATA TRANSMISSION SYSTEMS**
O. Koudelka and W. Riedler *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 91-97 refs Sponsored by Austrian Council for Scientific Research and Austrian Academy of Sciences (For primary document see N86-22811 13-32)
(Contract ESA-5085/82-NL-JS)
Avail: NTIS HC A10/MF A01

The results of a measurement program to characterize the reliability of an Mbit-per-second digital satellite data transmission system using small Earth terminals and OTS (ESA) are presented. The system was tested under various operational conditions and supporting investigations were made by simulations in a laboratory environment. Modem performance and the impact of forward error correction were emphasized. Results show that transmissions with low error rates can be performed. Author (ESA)

**N86-22823#** Danish Posts and Telegrams, Copenhagen. Radio Communications Office.
**ERROR PERFORMANCE AND AVAILABILITY DUE TO PROPAGATION FOR A SIMULATED 64 kbit/sec SATELLITE LINK AT 11 AND 14 GHz**
J. R. Larsen *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 99-102 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

Based upon 11 and 14 GHz beacon attenuation data, re-

corded every 0.1 sec for the worst months of up to 6 yr, the bit error rate (BER) for a simulated up or down-path 64 kbit/sec link was calculated. A linearized model characteristic, assuming a clear-sky BER of 10 to the minus 7.7 power was used for the transformation of all attenuation samples to number of bit errors. Using the availability criterion of CCITT recommendation G.821, the compliance with the present and proposed CCIR recommendations for digital satellite links was investigated. The analysis indicates that for such a satellite link in Denmark the recommendations using higher BER are not violated, when a clear-sky BER better than 10 to the minus 7.7 power is achieved. Author (ESA)

**N86-22824#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**RADIOMETRIC MEASUREMENTS OF SLANT-PATH ATTENUATION**
G. Brussaard *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 105-107 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The results of a campaign of long-term measurements of attenuation on slant paths with the aid of radiometers are presented. The analysis of the measurements was supplemented by a theoretical study into radiative transfer of thermal noise in rain. This study provided the framework for an empirical calibration of the radiometric measurements in terms of attenuation on satellite-Earth paths. Author (ESA)

**N86-22825#** International Telecommunications Satellite Organization, Washington, D. C.
**RADIOMETRIC PROPAGATION EXPERIMENTS IN TROPICAL REGIONS**
B. Arbesser-Rastburg, D. K. McCarthy, and J. E. Allnutt *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 109-113 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

In order to reduce the data gap for tropical regions propagation prediction models, INTELSAT instituted a 12 GHz radiometric measurement campaign in tropical, high rainfall rate regions. Results from two experiments indicate that there may be considerable differences between temperate and tropical climates in the prediction of single-site and diversity gain statistics. Author (ESA)

**N86-22826#** Technische Univ., Graz (Austria).
**RADIOMETRY, SCATTERING AND COHERENCE**
R. Lang and W. Riedler *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 115-118 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The utilization of the theory of partial coherence in microwave propagation research is outlined. Connections between coherence theory and the theory of radiative transfer are discussed. These connections can be used to compare the results gained via the coherence theory with quantities commonly used in propagation research. Author (ESA)

**N86-22827#** Essex Univ., Colchester (England). Dept. of Mathematics.
**COMMON VOLUME MODELLING FOR THE PREDICTION OF INTERFERENCE DUE TO SCATTERING BY HYDROMETEORS**
D. G. Charlton and A. R. Holt *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 119-122 refs (For primary document see N86-22811 13-32)
(Contract RDA/84/108)
Avail: NTIS HC A10/MF A01

Factors affecting the calculation of common volumes of radio links subject to rain or ice scattering are discussed. Sidelobes modeled by envelope patterns may result in significant increases in the effective common volume. This effect is most noticeable when considering situations involving a terrestrial beam with its associated high level sidelobes. In considering sidelobes, the width of the antenna beams has increased to such an extent that assumptions made when developing interference models may be questioned. It is shown, for realistic geometries, that the effects due to the refractive index height profile may significantly alter calculations of the effective volume. Author (ESA)

**N86-22828#** Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Studio per le Telecomunicazioni Spaziali.
**EXPERIMENTAL OPPORTUNITIES OFFERED BY ITALSAT IN TESTING SLANT-PATH PROPAGATION OF THE 20, 40 AND 50 GHz FREQUENCY BANDS**
F. Carassa, E. Matricciani, and A. Paraboni *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 123-131 refs Prepared in cooperation with Politecnico di Milano (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

Opportunities to measure atmospheric attenuation, depolarization by hydrometeors, wave-front angle of arrival and spatial coherence, phase distortion, amplitude distortion, incoherent radiation, and the transfer characteristics of the depolarizing channel using the ITALSAT satellite are described. Experiment configurations for 20, 40 and 50 GHz propagation are summarized. Author (ESA)

**N86-22829#** Politecnico di Milano (Italy). Dipt. di Elettronica.
**A REALISTIC MODEL OF THE HORIZONTAL STRUCTURE OF RAIN CELLS**
C. Capsoni, A. Paraboni, and A. Pawlina (CNR, Milan, Italy) *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 133-137 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

A large population of radar measured ground rain cells was used to devise and assess a rain cell model possessing a high degree of likelihood, for use in telecommunication applications. Various types of cell descriptors were studied to establish a basis for the identification of the model and for the evaluation of its degree of likelihood. It turns out that a population of cells characterized by exponentially shaped rain rate and marked spatial asymmetry in horizontal section best complies with the likelihood requirements. Author (ESA)

**N86-22830#** Technische Univ., Graz (Austria). Dept. of Communications and Wave Propagation.
**QUADRUPLE-SITE RADIOMETRIC DIVERSITY MEASUREMENTS AT 11.6 GHz**
W. L. Randeu, W. Riedler, and N. Witternigg *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 141-147 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

Results from a quadruple-site radiometric diversity experiment at 11.6 GHz are presented. Data cover 1 yr of continuous measurements. Considerable diversity gain is observed for dual-site pairs. The use of more than two sites increases diversity gain only negligibly. Caused by specific local weather mechanisms, no consistent dependency of diversity gain on site and path-separation is observed. Extrapolation to 20 and 30 GHz, based on relationships obtained from multifrequency radiometer measurements in the same area, confirms the importance of site diversity application at these and higher frequencies. Author (ESA)

**N86-22831#** Politecnico di Milano (Italy). Dipt. di Elettronica.
**ORBITAL DIVERSITY IN COMMUNICATION SYSTEMS AFFECTED BY RAIN**
Emilio Matricciani *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 149-155 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The effectiveness of Orbital Diversity (OD) to reduce power margins needed to overcome rain attenuation when the radio links to or from two satellites are designed with unequal power margins is shown. Quantitative results of a study-case (ITALSAT-Olympus) in the 30/20 GHz bands are given. It is shown that OD can employ a number of spare channels of the order of 1%, or less

of the number of assisted stations and that it is little sensitive to system growth in terms of new stations. Experimental data are reported, together with analysis of SIRIO-OTS simultaneous time series at 12 GHz. Author (ESA)

**N86-22832#** Portsmouth Polytechnic (England). Microwave (Telecommunications) Systems Research Group.
**MEASUREMENT AND MODELLING OF AMPLITUDE SCINTILLATIONS ON LOW-ELEVATION EARTH-SPACE PATHS AND IMPACT ON COMMUNICATION SYSTEMS**
O. P. Banjo and E. Vilar *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 157-161 refs Sponsored in part by International Telecommunications Satellite Organization (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

Measurements of amplitude scintillations on low-elevation (7.1 and 8.9 deg) satellite downlinks at X-band, including information on the diurnal and seasonal variability of the scintillation are described. The statistical distributions of scintillation amplitude and rms intensity are approximated using the Moulsley-Vilar model. An analytical approximation of this model is presented as a means of predicting long-term system outage time due to scintillations. Theoretical estimates of the average bit-error rate for a digital satellite link subject to scintillation fading are presented for NCFSK and CPSK modulations. Other ways in which scintillations can affect a satellite link are outlined. Author (ESA)

**N86-22833#** Naval Observatory, Washington, D.C.
**MODERN HIGH-PRECISION TIMEKEEPING** **c19**
W. J. Klepczynski *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 165-173 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The incorporation of hydrogen masers into timekeeping systems and the availability of commercial stored ion devices, and how they will affect timekeeping are discussed. Data on the performance of time transfer systems used to intercompare geographically separated clocks are presented. Author (ESA)

**N86-22834#** Technische Univ., Graz (Austria). Dept. of Communications and Wave Propagation.
**TIMING BY SATELLITE: METHODS, RECENT DEVELOPMENTS, AND FUTURE EXPERIMENTS**
D. Kirchner and W. Riedler *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 175-186 refs Sponsored by Austrian Council for Scientific Research and Austrian Academy of Sciences (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The principles of timing by satellite are introduced, and the use of the NAVSTAR/Global Positioning System and of communication satellites is described. The satellite-laser experiment LASSO and conceivable experiments using communication and direct-broadcast satellites are explained. Two experiments using the Space Shuttle are described. Author (ESA)

**N86-22835#** Stuttgart Univ. (West Germany). Inst. for Navigation.
**APPLICATION OF THE MICROWAVE TIME TRANSFER AND RANGING EXPERIMENTS (MITREX) MODEM TO RANGING AND NETWORK SYNCHRONIZATION**
Ph. Hartl *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 187-193 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

The modem designed for Microwave Time Transfer and Ranging Experiments (MITREX) is described. Position determination of telecommunication satellites by trilateration is possible quickly and precisely with this method. The simulation of the navigation task for satellite rendezvous and docking maneuvers and long baseline determination are discussed. Proposals on how to use the MITREX-modems in TDMA-network synchronization are presented. They are based on separating the TDMA-data transmission and the related synchronization tasks by generating a time reference with the PN-signal by MITREX-modems. This can increase the overall TDMA-efficiency, reduce the complexity of the TDMA hardware, and simplify the network management, thus making TDMA more attractive for networks with a greater number of Earth stations. Author (ESA)

**N86-22836*#** Stanford Univ., Calif. Space Telecommunications and Radioscience Lab.
**OBSERVATIONS OF SuB-LF ELECTROMAGNETIC FIELD PHENOMENA ASSOCIATED WITH MODULATED ELECTRON BEAMS ON STS-3 Final Technical Report, Apr. 1983 - Mar. 1984**
Antony C. Fraser-Smith, Peter M. Banks, and Geoffery D. Reeves Aug. 1985 36 p
(Contract NAGW-235; AF Proj. 230-5)
(NASA-CR-176692; NAS 1.26:176692; AD-A162543;
RADC-TR-85-152) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report provides initial documentation of some of the Sub-LF (frequencies less than 30kHz) electromagnetic field phenomena observed during the first active electron beam/space plasma experiment on a Space Shuttle orbiter. The experiment took place in March 1982 as part of the third flight of an orbiter, and it was notable for its particularly complete instrumentation for plasma and electromagnetic wave diagnostic measurements. A number of anomalous electric and magnetic field phenomena are observed during the electron beam modulation experiments, including the generation of noise bands, extra harmonics, and a variety of side frequencies. In addition, discrete ELF tones are observed during some of the dc electron beam pulse sequences, and there are peculiarities in the harmonic structure of the electromagnetic fields produced during lower-ELF modulation of the electron beam. Studies of these effects are continuing. GRA

**N86-22837#** Army Missile Command, Redstone Arsenal, Ala. Test and Evaluation Directorate.
**ELECTROMAGNETIC ENVIRONMENTAL CRITERIA FOR US ARMY MISSILE SYSTEMS: EMC (ELECTROMAGNETIC COMPATIBILITY), EMR (ELECTROMAGNETIC RADIATION), EMI (ELECTROMAGNETIC INTERFERENCE), EMP (ELECTROMAGNETIC PULSE), ESD (ELECTROSTATIC DISCHARGE), AND LIGHTNING**
Charles D. Ponds Jan. 1985 59 p
(AD-A162577; AD-E950778; AMSMI/RT-85-14-TR) Avail: NTIS HC A04/MF A01 CSCL 16/4

This report presents the design and test requirements in developing an electromagnetic compatibility missile system. Environmental levels are presented for electromagnetic radiation hazards, electromagnetic radiation operational electrostatic discharge, lightning, and electromagnetic pulse (nuclear). Testing techniques and facility capabilities are presented for research and development testing of missile systems. Author (GRA)

**N86-22838#** Army Military Personnel Center, Alexandria, Va.
**ESTIMATING COMPUTER COMMUNICATION NETWORK PERFORMANCE USING NETWORK SIMULATIONS Final Report**
Albert B. Garcia Apr. 1985 154 p
(AD-A162580) Avail: NTIS HC A08/MF A01 CSCL 17/2

A generalized queueing model simulation of store-and-forward computer communication networks is developed and implemented using Simulation Language for Alternative Modeling (SLAM). The model includes an ACK/NAK data link protocol, four-level message precedence, finite queues and a response traffic scenario. Network performance, indicated by average message delay and message throughput is estimated using the simulation model. GRA

**N86-22839#** Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
**THE THEORY OF DETECTION IN INCOMPLETELY CHARACTERIZED NON-GAUSSIAN NOISE Report, Aug. 1984 - Jul. 1985**
Steven Kay Nov. 1985 39 p
(Contract N00014-84-K-0527)

(AD-A162607; Rept-2) Avail: NTIS HC A03/MF A01 CSCL 09/3

The problem of detecting a signal known except for amplitude in non-Gaussian noise is addressed. The noise samples are assumed to be independent and identically distributed with a probability density function known except for a few parameters. Using a generalized likelihood ratio test it is proven that for a symmetric noise probability density function the detection performance is asymptotically equivalent to that obtained for a detector designed with a priori knowledge of the noise parameters. A computationally more efficient but equivalent test is proposed and a computer simulation performed to illustrate the theory. Author (GRA)

**N86-22840#** Department of the Air Force, Washington, D.C.
**SITUATION AWARENESS MODE Patent Application**
Robert A. Phillips, inventor (to Air Force) Filed 5 Sep. 1985 30 p
(AD-D012015; US-Patent-Appl-SN-772813) Avail: NTIS HC A03/MF A01 CSCL 17/9

A modification is presented to improve radar systems, which normally track a single target, to enable them to perform a simultaneous search of a large space volume while maintaining track of a selected target. This modification entails an operating process in which a search is conducted with a controlled search pattern and search time so that the antenna is as close as possible to the tracked target position at the search conclusion and antenna slewing time is minimized. Finally, the present procedure can be implemented while adding as little as one thousand words of memory to the radar system. Author (GRA)

**N86-22841#** Department of the Army, Washington, D. C.
**ERROR PROCESSING TECHNIQUE FOR MODIFIED READ CODE Patent Application**
Stephen J. Urban and Charles D. Bodson, inventors (to Army) Filed 27 Sep. 1985 23 p
(AD-D012024; US-Patent-Appl-SN-780751) Avail: NTIS HC A02/MF A01 CSCL 17/2

A method of error processing is disclosed in which the first erroneous line detected in a facsimile transmission is decoded, and printed in the normal manner, up to the point in the line where an error is detected. An erroneous portion of the line is then defined to be the point in the line from which the error is detected as well as four color changes to the left. This erroneous portion is replaced by the corresponding picture elements in the immediately preceding line. The resulting corrected line is then used as new previous line and the process is repeated with the erroneous portion of each subsequent line being replaced with white until a full line is properly decoded. GRA

**N86-22842#** Mound Lab., Miamisburg, Ohio.
**SIGNAL LINE CABLE EVALUATION**
D. R. Knick and P. M. Meyers 22 Oct. 1985 15 p
(Contract DE-AC04-76DP-00053)
(DE86-002838; MLM-MU-85-70-0002) Avail: NTIS HC A02/MF A01

This technical evaluation compares the LDF4-50A and the RG-213/U signal line cables using N connectors. These two signal lines were considered for data acquisition lines in the Component Test Facility. The signal lines were evaluated for delay characteristics and frequency response. Other evaluation criteria were ease of handling, ease of attaching connectors, and cost. The signal line cable that most closely meets the goals of the Component Test Facility is the LDF4-50A. DOE

**N86-22843#** Argonne National Lab., Ill.
**ELECTRONIC MAIL AT ANL**
B. Finkel, M. Andre, and K. Janoski Sep. 1985 157 p
(Contract W-31-109-eng-38)
(DE86-002029; ANL/TM-431) Avail: NTIS HC A08/MF A01

Concepts, issues, and commands basic to electronic mail are discussed and the capabilities and limitations of the electronic mail systems currently in place at Argonne National Laboratory is described, with an emphasis on communication through the Bitnet network. The primary purpose of this document is to complement the detailed information found in vendor documents on electronic mail. You can find the details and procedures of specific electronic mail systems in the appropriate manuals listed in the Bibliography. DOE

**N86-22844#** MATRA Espace, Paris-Velizy (France).
**GROUND SEGMENT CONCEPT FOR A DATA RELAY SATELLITE, PHASE 1 Final Report**
A. Dignan, E. Golden, M. Hervieux, J. N. Moreau, P. Hansell (Logica Ltd.), and D. Nolan (Logica Ltd.) Paris ESA Jan. 1985 90 p
(Contract ESOC-5645/83-D-JS(SC))
(MATRA-140/MH.07385; ESA-CR(P)-2098) Avail: NTIS HC A05/MF A01

The functions and the architecture of a ground segment operating a European data relay system were defined, assuming that ESOC facilities located at Darmstadt (West Germany) are reused. The retained scheme is based on a centralized concept, where all the data transit (forward and return) to the data relay satellite is centralized by the ground segment. The main problems are: implementation of the diversity at the ground station (required in Ka band by link availability requirements); as the existing (and foreseen) communication networks are not adapted to the high rate data flow dissemination, the real time dissemination of such data pose a problem which was not solved. Author (ESA)

**N86-22845#** Bureau of Mines, University, Ala.
**GROUND-PENETRATING RADAR FOR STRATA CONTROL Investigations Report, 1985**
R. H. Church, W. E. Webb, and J. R. Boyle 1985 23 p
(PB86-108354; LC-84-600392; BM-RI-8954) Avail: NTIS HC A02/MF A01 CSCL 08I

As part of the Bureau of Mines health and safety research program in strata control, a ground-penetrating radar (GPR) system capable of penetrating approximately 10 ft into the mine roof has been devised to identify anomalistic conditions. The GPR system consists of a transmitter utilizing a dipole antenna, and a receiver, consisting of a dipole antenna fed into a sampler with a time base housed in a storage oscilloscope. A computer was utilized for data acquisition and data processing. Data analysis by computer enhancement revealed recognizable return radar signatures from the middle man rock and main roof of the test site. Early recognition of such features could lead to immediate corrective actions and result in the saving of lives. GRA

**N86-22846#** National Bureau of Standards, Washington, D.C. Electromagnetic Fields Div.
**NEAR-FIELD ARRAY OF YAGI-UDA ANTENNAS FOR ELECTROMAGNETIC SUSCEPTIBILITY TESTING**
D. A. Hill and G. H. Koepke Jul. 1985 84 p
(PB86-102688; NBS/TN-1082) Avail: NTIS HC A05/MF A01 CSCL 09E

A seven-element array of Yagi-Uda antennas was constructed at a frequency of 500 MHz to measure the electrosusceptibility of plane waves. The element weightings are determined by a near-field synthesis technique which optimizes the uniformity of the field throughout a rectangular test volume in the near field of the array. The amplitude and phase of the electric field were measured throughout the test volume with a short dipole probe, and it is found that the agreement with the theory is excellent. E.A.K.

**N86-22847#** Sigma Research, Inc., Seattle, Wash.
**DEVELOPMENT OF A PIPE LOCATION SYSTEM, PHASES 2 AND 3 Final Report, Nov. 1981 - Oct. 1984**
T. J. Davis Dec. 1984 74 p
(Contract GRI-5080-353-0335)
(PB86-102902; GRI-85/0162) Avail: NTIS HC A04/MF A01 CSCL 20N

Capability for high resolution imaging of buried gas pipe has been demonstrated under this research project. A synthetic aperture focusing technique (SAFT) was combined with ground penetrating radar for this application. Resolution of objects

separated by as little as 2 to 4 inches at depths of four feet was obtained. The technology appears capable, with some refinement, of providing the basis for field mapping systems. Extensive research was conducted to apply both radar and acoustic methods to the problem since the dual capability would accommodate a greater variety of soils. These methods were evaluated in conjunction with holographic imaging as well as SAFT. GRA

**N86-22751#** Joint Publications Research Service, Arlington, Va.
**PASSIVE LOCATION, TRACKING FOR MOVING EMITTERS**
Zhongkang Sun and Peng Zhang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 71-79 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 13, no. 2, Mar. 1985 p 74-79 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22769#** Joint Publications Research Service, Arlington, Va.
**THEORY, CALCULATION OF LARGE SIGNAL CUT-OFF ZONE IBCFA**
Ping Zhou and Keqian Zhang *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 74-85 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 2, no. 2, Mar. 1983 p 45-51 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

**N86-22772#** Joint Publications Research Service, Arlington, Va.
**ELECTROSTATIC LENS OF NEW TYPE FIELD EMISSION GUN**
Yushan Tu *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 112-116 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 12, no. 1, Jan. 1984 p 119-121 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

# 33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

**N86-22848** Arizona Univ., Tucson.
**THE QUALITY OF SYNTHESIZED SPEECH USING LINEAR PREDICTIVE CODING ON FINITE WORDLENGTH INTEGRATED CIRCUITS Ph.D. Thesis**
Gerrard Merrill Carlson 1985 174 p
Avail: Univ. Microfilms Order No. DA8525589

The quality of synthetic speech produced by integrated circuit (IC) hardware using fixed-point arithmetic and Linear Predictive Coding (LPC) was studied. A theoretical model explaining the combined effects of finite wordlength and parametric model order is developed. This model is used to predict the results obtained in the experimental phase. In the experimental phase, selected model utterances are synthesized under finite wordlength constraints using LPC parameters. The synthetic speech is evaluated in terms of the log area ratios which define objective speech quality as a parametric distance. A theoretical model is developed to predict the experimental results. Simulations of this model produce data that predict the experimental results. The same information is extracted from the model as that obtained from actually running the fixed-point synthesizer simulator.
Dissert. Abstr.

**N86-22849** Department of the Air Force, Washington, D.C.
**TRI-STATE TYPE DRIVER CIRCUIT Patent**
John J. Ennis and Robert K. Booher, inventors (to Air Force) Issued 10 Sep. 1985 9 p Supersedes AD-D010306
(AD-D012002; US-Patent-4,540,904; US-Patent-Appl-SN-491108) Avail: US Patent and Trademark Office CSCL 09/5

An FET complementary pair provides the output to a data line. A data input line is coupled to the gate of the P-FET via an OR gate configuration, and to the gate of the N-FET via an AND gate configuration. The output of each gate configuration is cross-connected to an input of the other. When the input data state changes, the two gate configurations provide delays which are effectively in tandem, so that the FET which was ON is first turned OFF, and after a short delay the other is turned ON. This delay ensures that both FET's are not ON at the same time, which prevents an undesirable power flow. To provide a high impedance float state, an enable input and its complement are connected to the AND and OR gate configurations respectively. Author (GRA)

**N86-22850** Department of the Air Force, Washington, D.C.
**NARROW DEVIATION VOLTAGE CONTROLLED CRYSTAL OSCILLATOR Patent**
Michael M. Driscoll, inventor (to Air Force) Issued 27 Jan. 1984 7 p Supersedes AD-D012021
(AD-D012021; US-Patent-4,550,293; US-Patent-Appl-SN-574434; US-Patent-Class-331-116) Avail: US Patent and Trademark Office CSCL 09/5

A narrow band, voltage controlled crystal oscillator having a linear frequency versus tuning voltage response. The oscillator uses a composite resonator in a novel circuit configuration with a resulting improvement in oscillator output signal frequency stability. Author (GRA)

**N86-22851** Department of the Air Force, Washington, D.C.
**NARROW PULSEWIDTH PULSE GENERATOR CIRCUIT UTILIZING NPN MICROWAVE TRANSISTORS Patent**
Stephen P. Caldwell and David R. Pedersen, inventors (to Air Force) Issued 8 Oct. 1985 6 p Supersedes AD-D010781
(AD-D012022; US-Patent-4,546,268; US-Patent-Appl-SN-559561; US-Patent-Class-307-265) Avail: US Patent and Trademark Office CSCL 10/2

A pulse generator circuit for providing pulses having pulse widths in the order of one nanosecond. The circuitry utilizes NPN microwave transistors exclusively to achieve this result.
Author (GRA)

**N86-22852#** Stanford Univ., Calif. Lab. of Physics.
**ELECTROMAGNETIC SENSOR ARRAYS FOR NONDESTRUCTIVE EVALUATION AND ROBOT CONTROL Annual Report, 1 Sep. 1984 - 31 Aug. 1985**
B. A. Auld, J. Kenney, T. Lookabaugh, and M. Gimple Oct. 1985 23 p
(Contract F49620-84-C-0095)
(AD-A161292; AFOSR-85-0970TR) Avail: NTIS HC A02/MF A01 CSCL 14/2

A conceptual base is being developed for the design of inductive (eddy-current) and capacitive sensor arrays capable of providing multifunction sensing, including proximity, tactile and edge recognition. Flaw detection and characterization is also included. The physical base for design is the electromagnetic reciprocity relation, which permits configuration of the probe structure to achieve desired performance characteristics. In this report the design, construction and testing of a novel 5-coil inductive sensor is described, and experimental results are given for its edge sensing function. GRA

**N86-22853#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**THE EFFECTS OF ADDITIVES ON NICKEL ELECTRODE DISCHARGE KINETICS**
Albert H. Zimmerman and Peter K. Effa 30 Sep. 1985 34 p
(Contract F04701-83-C-0084)
(AD-A161310; TR-0084A(5945-01)-1; SD-TR-85-68) Avail: NTIS HC A03/MF A01 CSCL 09/1

The effects of Ba, Cd, Co, Li, Mn, and Zn additives on the impedance of porous nickel electrodes have been measured. The resistance to proton diffusion in the charged electrode is decreased only by Li, Co, and Mn additives. The charge transfer resistance

of the nickel electrode can be decreased up to two orders of magnitude by Co and Li additives. The electronic resistance of the discharged active material is reduced significantly by Mn and Co and to a lesser extent by Li. Data are presented indicating that the resistance characteristics correlate with performance during high rate cycling, and that the effects of additives on the physical structure of the active material deposit can be just as important as changes on conductivity. GRA

**N86-22854#** Department of the Air Force, Washington, D.C.
**TiW/Si SELF-ALIGNED GATE FOR GaAs MESFETs Patent Application**
William V. McLevige, inventor (to Air Force) Filed 6 Jun. 1985 16 p
(AD-D012001; US-Patent-Appl-SN-741643) Avail: NTIS HC A02/MF A01 CSCL 09/5

A major difficulty with fabricating GaAs digital logic circuits using enhancement-mode MESFETs has been the large gate-source and gate-drain parasitic resistances inherent in conventional designs. A self-aligned gate process is presented, which incorporates a mushroom gate structure for self-aligning both an n+ implant and the source/drain contacts to the gate, thus minimizing the parasitic resistances. The mushroom gate consists of a two-layer TiW/Si metallization in which the bottom TiW layer is undercut with a closely controllable chemical etch. The process is compatible with the high temperature anneal necessary to activate ion-implanted GaAs. GRA

**N86-22855#** Department of the Air Force, Washington, D.C.
**LINEAR GEOMETRY THYRATRON Patent Application**
Stanley Byron, inventor (to Air Force) Filed 6 Mar. 1985 23 p
(AD-D012016; US-Patent-Appl-SN-708910) Avail: NTIS HC A02/MF A01 CSCL 09/1

The low pressure gas-filled thyratron is scalable in the long dimension. Internally the tube is formed as a tetrode, with an auxiliary grid placed between the cathode and the control grid. A dc or pulsed power source drives the auxiliary grid both to insure uniform cathode emission and to provide a grid-cathode plasma prior to commutation. The high voltage holdoff structure consists of the anode, the control grid and its electrostatic shielding baffles, and a main quartz insulator. A small gas flow supply and exhaust system is used that eliminates the need for a hydrogen reservoir and permits other gases, such as helium, to be used. The thyratron provides a low inductance, high current, long lifetime switch configuration: useful for switch-on applications involving large scale lasers and other similar loads that are distributed in a linear geometry. GRA

**N86-22856#** Department of the Air Force, Washington, D.C.
**DIRECT MOAT SELF-ALIGNED FIELD OXIDE TECHNIQUE Patent Application**
Cricchi, inventor (to Air Force) Filed 21 Oct. 1985 10 p
(AD-D012018; US-Patent-Appl-SN-789863) Avail: NTIS HC A02/MF A01 CSCL 09/5

A process is used to produce high density radiation hardened Complementary Metal Oxide Semiconductor (CMOS) circuits. The steps are as follows: (1) growing a field oxide layer including any specialized hardening techniques thereto on a silicon wafer; (2) depositing a material which will serve as an implant mask such as aluminum; (3) etching this layer to leave shapes where the thin oxide gate regions are to be; (4) depositing a spacer material such as sputtered nitride onto the shapes; (5) etching the spacer material; (6) depositing a field implant mask; (7) etching the implant mask; (8) implanting the field regions; (9) stripping the implant mask; (10) stripping the spacer material is used; (11) depositing a secondary masking layer such as Ti-W or W; (12) bias sputtering away secondary masking material at edges of aluminum shapes; (13) removing aluminum shapes using secondary material as a mask; (14) etching oxide under aluminum shapes to reach the silicon wafer; (15) stripping secondary masking layer; (16) growing gate oxide; (17) removing field oxide layer to expose source and drain regions in the wafer; and (18) placing electrodes into the drain, source and gate regions. GRA

**N86-22857#** Department of the Army, Washington, D. C.
**SINGLE PLANE TRANSIENT VOLTAGE SUPPRESSION DEVICE ASSEMBLY Patent Application**
Leon H. Riley, inventor (to Army) Filed 23 Sep. 1985 7 p
(AD-D012023; US-Patent-Appl-SN-778941) Avail: NTIS HC A02/MF A01 CSCL 10/2

This transient voltage suppression device (TVSDA) provides for two sets of connectors (one input and one output) to be mounted in a single plane. Voltage suppression devices are connected, in a low parasitic inductance fashion, between leads interconnecting separate connector pins and the body of the TVSDA. The TVSDA has a minimum VSD lead length. Author (GRA)

**N86-22858#** Lawrence Livermore National Lab., Calif.
**POTENTIAL FOR EFFICIENT FREQUENCY CONVERSION AT HIGH AVERAGE POWER USING SOLID STATE NONLINEAR OPTICAL MATERIALS**
D. Eimerl 28 Oct. 1985 138 p
(Contract W-7405-eng-48)
(DE86-001931; UCID-20565) Avail: NTIS HC A07/MF A01

High-average-power frequency conversion using solid state nonlinear materials is discussed. Recent laboratory experience and new developments in design concepts show that with current technology, a few tens of watts may be extended by several orders of magnitude. For example, using KD*P, efficient doubling (> 70%) of Nd:YAG at average powers approaching 100 KW is possible; and for doubling to the blue or ultraviolet regions, the average power may approach 1 MW. Configurations using segmented apertures permit essentially unlimited scaling of average power. High average power is achieved by configuring the nonlinear material as a set of thin plates with a large ratio of surface area to volume and by cooling the exposed surfaces with a flowing gas. The design and material fabrication of such a harmonic generator are well within current technology. DOE

**N86-22859#** California Univ., Berkeley. Lawrence Berkeley Lab.
**Ge:Be FAR INFRARED PHOTOCONDUCTORS**
N. M. Haegel and E. E. Haller Aug. 1985 16 p refs Presented at the IR Detector Technology Workshop, Mountain View, Calif., 13 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001979; LBL-20238; CONF-8508141-1) Avail: NTIS HC A02/MF A01

Germanium:Beryllium photoconductors have been optimized for the 30 to 50 micron m wavelength range. Crystal growth of detector quality material requires good control of both the Be and residual impurity doping. Detective quantum efficiencies of eta(sub d) = 46% at 5 A/W have been achieved at a photon background of 10 to the 8th power p/s. The responsivity of Ge:Be detectors can be strongly temperature-dependent when the residual shallow levels in the material are closely compensated. Transient responses on the order of approx. 1 second have been observed in some materials. The role of residual shallow impurities on the performance of photoconductors doped with semi-deep and deep impurities is discussed. DOE

**N86-22860#** California Univ., Berkeley. Lawrence Berkeley Lab.
**STATUS OF NTD Ge BOLOMETER MATERIAL AND DEVICES**
E. E. Haller, N. M. Haegel, and I. S. Park Aug. 1985 15 p refs Presented at the IR Detector Technology Workshop, Mountain View, Calif., 13 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001988; LBL-20237; CONF-8508141-2) Avail: NTIS HC A02/MF A01

The first IR Detector Technology Workshop took place at NASA Ames Research Center on July 12 and 13, 1983. The conclusions presented at that meeting are still valid. More has been learned about the physics of hopping conduction at very low temperatures which will be important for bolometer design and operation at ever decreasing temperatures. Resistivity measurements have been extended down to 50 mK. At such low temperatures, precise knowledge of the neutron capture cross sections sigma(sub n) of the various Ge isotopes is critical if one is to make an

accurate prediction of the dopant concentrations and compensation, and therefore resistivity, that will result from a given irradiation. An empirical approach for obtaining the desired resistivity material and is described the process of conducting a set of experiments which will improve the knowledge of the effective sigma(sub n) values for a given location in a particular reactor is discussed. A wider range of NTD Ge samples is now available. Noise measurements on bolometers with ion implanted contacts show that no 1/f noise component appears down to 1 Hz and probably lower. DOE

**N86-22861#** Oak Ridge National Lab., Tenn.
**FRACTAL MODEL FOR THE ac RESPONSE OF A ROUGH INTERFACE**
T. Kaplan, S. H. Liu, and L. J. Gray Aug. 1985 4 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract DE-AC05-84OR-21400)
(DE85-018093; CONF-851217-2) Avail: NTIS HC A02/MF A01

The ac response of an interface between two materials of very different conductivities (e.g., an electrode and an electrolyte) cannot be simply modeled by a resistor and a capacitor. Instead it is found necessary to include a constant-phase-angle (CPA) element whose impedance has the form Z((LC OMEGA)) infinity (j(LC OMEGA))(sup -eta), where (LC OMEGA) is the angular frequency, j = (RADICAL)-1, and 0 < eta < 1. Furthermore, it is observed that the parameter eta is intimately related to surface roughness, with eta approaching unity when the surface is made increasingly smooth. DOE

**N86-22862#** Sandia National Labs., Albuquerque, N. Mex.
**DAMAGE DUE TO HOT-CARRIER AND RADIATION EFFECTS IN MOS TRANSISTORS**
J. D. McBrayer, D. M. Fleetwood, R. A. Pastorek, and R. V. Jones 1985 5 p Presented at the 16th Semiconductor Interface Specialists Conference, Ft. Lauderdale, Fla., 5 Dec. 1985
(Contract DE-AC04-76DP-00789)
(DE85-018275; SAND-85-2068C; CONF-851233-1) Avail: NTIS HC A02/MF A01

The relative types and magnitudes of damage produced by ionizing radiation and hot carriers for a current CMOS technology are discussed and these effects are related to each other. DOE

**N86-22863#** Bell Communications Research, Inc., Murray Hill, N.J.
**ELECTRON MICROSCOPY OF REACTIONS ON COMPOUND SEMICONDUCTOR SURFACES**
T. Sands, V. G. Keramidas, J. Washburn, and R. Gronsky Aug. 1985 29 p Presented at the Electronic Materials Conference, Boulder, Colo., 18 Jun. 1985 Prepared in cooperation with Lawrence Berkeley Lab., CA.
(Contract DE-AC03-76SF-00098)
(DE86-000623; LBL-19764; CONF-8506207-1) Avail: NTIS HC A03/MF A01

In compound semiconductor discrete devices and integrated circuits, interfacial structure and integrity in multilayered structures is of paramount importance. Ohmic contacts, Schottky barriers, interconnect metallizations, active and passive dielectric layers and implanted or chemically formed semiconductor heterojunctions are attained by the deposition of reactant species and subsequent thermal treatment. The performance criteria and long-term reliability of such structures require that the interfaces be planar and the reacted layers be laterally uniform. Application of transmission electron microscopy to the study of such structures leads to an understanding of the factors which influence and often control the evolution of interfacial compositions and morphologies during deposition and annealing. Four types of reactions on compound semiconductors (formation of layered binary compounds, formation of ternary phases, cation exchange and anion accumulation) are described and illustrated with electron microscopy results from selected examples. DOE

**N86-22864#** Stanford Univ., Calif. Integrated Circuits Lab.
**NEW INTEGRATED POLYSILICON PHOTOCONDUCTORS FOR ULTRAFAST MEASUREMENTS ON SILICON**
D. R. Bowman, R. B. Hammond, and R. W. Dutton 1985 18 p refs Presented at the IEEE International Electron Devices Meeting, Washington, D.C., 1 Dec. 1985 Prepared in cooperation with Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-36)
(DE86-000820; LA-UR-85-3323; CONF-851237-1) Avail: NTIS HC A02/MF A01

A fully-integrated silicon-optical-switch technology is reported that demonstrates one picosecond sampling aperture when excited by a femtosecond laser. Fabrication of the polycrystalline-silicon-switch structure is accomplished with standard-integrated-circuit processing techniques to insure full compatibility with standard-VLSI processes. Photoresist-masked ion-beam irradiation is used to generate trapping sites in the photoconductive layer and tailor the switch on-time. Limited optimization of process parameters resulted in photoconductors demonstrating 3-dB measurement bandwidths over 100 GHz when used as sampling gates. A model for the device performance has been developed and is compared with experimental results. Application of the optical switch in a high speed sampling system for the measurement of striplines on a silicon wafer demonstrated dispersive effects that have been observed for the first time. DOE

**N86-22865#** California Univ., Berkeley. Lawrence Berkeley Lab.
**FURTHER MEASUREMENTS OF ELECTRON TRANSMISSION AND AVALANCHE GAIN IN NARROW LEAD GLASS TUBING**
I. Fujieda, T. A. Mulera, V. Perez-Mendez, and A. delGuerra Oct. 1985 7 p refs Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985 Prepared in cooperation with Pisa Univ, Italy
(Contract DE-AC03-76SF-00098)
(DE86-001983; LBL-20366; CONF-851009-1) Avail: NTIS HC A02/MF A01

Measurements of electron transmission and multiplication in lead glass tube arrays, in which a resistive field shaping electrode is provided by reduction of a surface layer of lead oxide, have been continued. The transmission losses have been successfully modeled allowing the true avalanche gains to be extracted. Gains of up to 100 have been observed. Applications as a photon shield in Cherenkov imaging detectors are discussed. DOE

**N86-22866#** California Univ., Berkeley. Lawrence Berkeley Lab.
**MACROSCOPIC QUANTUM EFFECTS IN THE ZERO VOLTAGE STATE OF THE CURRENT BIASED JOSEPHSON JUNCTION**
J. Clarke, M. H. Devoret, J. Martinis, and D. Esteve May 1985 21 p Presented at the 3rd International Conference on Superconducting Quantum Devices, Berlin, West Germany, 25 Jun. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001985; LBL-19652; CONF-8506203-3) Avail: NTIS HC A02/MF A01

When a weak microwave current is applied to a current-biased Josephson tunnel junction in the thermal limit the escape rate from the zero voltage state is enhanced when the microwave frequency is near the plasma frequency of the junction. The resonance curve is markedly asymmetric because of the anharmonic properties of the potential well: this behavior is well explained by a computer simulation using a resistively shunted junction model. This phenomenon of resonant activation enables one to make in situ measurements of the capacitance and resistance shunting the junction, including contributions from the complex impedance presented by the current leads. For the relatively large area junctions studied in these experiments, the external capacitive loading was relatively unimportant, but the damping was entirely dominated by the external resistance. DOE

**N86-22867#** Los Alamos National Lab., N. Mex.
**SSC KICKER IMPEDANCES**
E. P. Colton and T. F. Wang 1985 9 p Presented at the SSC Impedance Workshop, Berkeley, Calif., 26 Jun. 1985
(Contract W-7405-eng-36)

(DE86-002434; LA-UR-85-3816; CONF-8506212-1) Avail: NTIS HC A02/MF A01

The longitudinal and transverse complex impedances Z/sub l//n and Z/sub t/, respectively, have been calculated for both the SSC injection and abort kickers. The calculations assumed that no attempt was made to shield the beam from the kickers. We took the injection and abort kickers to be as specified. The injection kickers were ferrite with a single-turn design, and the abort kickers were of a window-frame design with tape wound cores. DOE

**N86-22868#** Lawrence Livermore National Lab., Calif.
**MODELING ON-RESISTANCE FOR SILICON PHOTOCONDUCTIVE SWITCHING DEVICES**
J. D. Morse 22 Aug. 1985 21 p
(Contract W-7405-eng-48)
(DE86-002611; UCID-20533) Avail: NTIS HC A02/MF A01

Analytical models have been developed in order to characterize the on-resistance of silicon photoconductive switching devices as a function of the optical energy absorbed. It has been shown that by using a more exact mobility model which accounts for physical effects on the carrier mobility, significant changes in conductance are found for the same device structure. The effects accounted for in this more exact model are electric field degradation, carrier-carrier interactions, and temperature effects. Further work in this area should concentrate on obtaining experimental data to verify these results, along with the development of more exact numerical models to account for two-dimensional drift and diffusion effects on device performance. DOE

**N86-22869#** Los Alamos National Lab., N. Mex.
**KIND OF HIGH-QUALITY TRIGGER CIRCUIT USED IN FIELD MEASUREMENT**
Y. Yang and X. Zhang 1985 5 p Translated from Pao Cha Yu Ch'ung-chi (China), no. 1, 1981 p 97-98
(Contract W-7405-eng-36)
(DE86-002862; LA-tr-85-49) Avail: NTIS HC A02/MF A01

In field measurements, complicated working conditions and the one-time nature of the experiments place rather high operational stability requirements on the measuring system. For some measurements, the trigger circuit is a rather important link. Its performance not only affects whether or not measurement results are obtained, but also influences whether or not the results are satisfactory. This paper shows the advantages of the utilization of this trigger circuit. Its operation is stable and reliable, its resistance to interference is great, its circuit is simple, its volume is small, and it conserves electricity. In field measurements of numerous large scale blasts we obtained satisfactory results for several modes of usage. DOE

**N86-22870#** California Univ., Berkeley. Lawrence Berkeley Lab.
**SPATIALLY-RESOLVED INVESTIGATION OF TRANSPORT IN SEMICONDUCTORS: A PHOTOTHERMAL DEFLECTION APPROACH**
A. Skumanich, D. Fournier, A. C. Boccara, and N. M. Amer Jun. 1985 7 p Presented at the 4th International Topical Meeting on Photoacoustic, Thermal and Related Sciences, Quebec, Canada, 4 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002872; LBL-20186; CONF-850886-5) Avail: NTIS HC A02/MF A01

The unique ability of photothermal deflection spectroscopy to probe the local index of refraction of matter is exploited to investigate, in a spatially-resolved manner, thermal and electronic transport in semiconductors. An added advantage of this approach is that it is contactless; hence, it obviates the classical problems associated with electrodes and contacts. The basic premise of the technique is the use of the heat associated with non-radiative processes (e.g., recombination of carriers) to deflect a focussed laser probe beam (sub-gap energy) propagating through the semiconductor. The deflection of the probe beam is caused by a change in the refractive index of the sample which is in turn governed by carrier diffusion and recombination. DOE

**N86-22871#** Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology.
**TEST AND EVALUATION OF THE CHLORIDE SPEGEL S1P108/30 ELECTRIC VEHICLE BATTERY CHARGER**
R. L. Driggans and A. S. Keller Sep. 1985 52 p
(DE86-900228; TVA/PE/EDT-85/23) Avail: NTIS HC A04/MF A01

The Chloride Spegel Model S1P108/30 electric vehicle battery charger was tested by the Tennessee Valley Authority (TVA) as an account of work sponsored by the Electric Power Research Institute (EPRI). Charger input/output voltage, current, and power characteristics and input waveform distortion were measured; and induced electromagnetic interference was evaluated as the charger recharged a lead-acid battery pack. Electrical quantities were measured with precision volt-ampere-watt meters, frequency counters, a digital-storage oscilloscope, and a spectrum analyzer. THe Chloride charger required 8.5 hours to recharge a 216V tubular plate lead-acid battery from 100 percent depth of discharge (DOD). Energy efficiency was 83 percent, specific power was 37.4 W/kg (17.0 W/lb), input current distortion varied from 22.4 to 34.1 percent, and electromagnetic interference was observed on AM radio. Tests were conducted with the battery at initial DOD of 100, 75, 50, and 25 percent. Charge factor was 1.14 from 100-percent DOD, increasing to 1.39 from 25-percent DOD. DOE

**N86-22872#** Stanford Linear Accelerator Center, Calif.
**MEAN LIFE OF KLYSTRONS**
M. Sands 30 Oct. 1985 7 p
(Contract DE-AC03-76SF-00515)
(DE86-002381; SU-SLAC-CN-310) Avail: NTIS HC A02/MF A01

It would be useful to have the best possible estimate of this mean life-time of our new klystrons based on the most recent, available operating experience. A simple formula is given for this best estimate, based on the maximum likelihood method. This method also provides an indication of the reliability of the estimated lifetime. The results given here apply uniquely to a uniform klystron population for which we can assume that deaths occur randomly, and independently of the previous history (operating time) of any one klystron. DOE

**N86-22873#** Los Alamos National Lab., N. Mex.
**RADIATION EFFECTS ON VIDEO IMAGERS**
G. J. Yates, J. J. Bujnosek, S. A. Jaramillo, R. B. Walton, T. M. Martinez, and J. P. Black 1985 9 p Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985 Prepared in cooperation with EG and G, Inc., Los Alamos, N. Mex.; EG and G, Inc., Albuquerque, N. Mex.
(Contract W-7405-eng-36)
(DE86-002435; LA-UR-85-3803; CONF-851009-8) Avail: NTIS HC A02/MF A01

Radiation sensitivity of several photoconductive, photoemissive, and solid state silicon-based video imagers was measured by analyzing stored photocharge induced by irradiation with continuous and pulsed sources of high energy photons and neutrons. Transient effects as functions of absorbed dose, dose rate, fluences, and ionizing particle energy are presented. DOE

**N86-22874#** United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
**A DESIGN OF CPV AND BIPOLAR ASSEMBLIES OF NICKEL/HYDROGEN CELL STACKS (SUMMARY ONLY)**
T. L. Markin, S. Y. Moss, and D. N. E. Smith Paris ESA May 1985 10 p 2 Vol.
(Contract ESTEC-5719/83-NL-AN(SC))
(AERE-G-3349-Vol-1; ESA-CR(P)-2106-Vol-1) Avail: NTIS HC A02/MF A01

A conceptual design of a Common Pressure Vessel (CPV) assembly of nickel/hydrogen cell stacks is described. The design features two 85 Ah cell stacks, giving a capacity of 210 Wh in a cylindrical composite vessel. The design is estimated to yield a gravimetric energy density of 71 Wh/kg and a volumetric energy density of 85.5 Wh/l (60 bar), although the significance of the latter figure is qualified. The preference for the two-stack module

is largely influenced by the flexibility it allows for battery assembly. A study of bipolar assemblies identified interesting concepts, but no single preference. Simulations of the thermal performance of both designs for GEO and LEO cycles, against a number of idealized boundary conditions, indicate that the desired operating temperature range is maintainable with adequate boundary temperature control. Author (ESA)

**N86-22875#** United Nations Industrial Development Organization, Vienna (Austria).
**APPROACH TO REGIONAL MICROELECTRONICS CO-OPERATION PROGRAMME**
S. Wajnberg 24 Jun. 1985 14 p
(PB86-104668; UNIDO-ID/WG.440/11; V.85-28527) Avail: NTIS HC A02/MF A01 CSCL 09A

Regional cooperation in the ECLAC region in the field microelectronics (based on experience in Brazil) - covers (1) the electronics industry (2) approach to a relevant cooperation program (TCDC) (3) projects concerning microelectronic components including integrated circuits; finished products; input (4) research and development (5) education and training required to obtain experts and technical personnel. GRA

**N86-22876#** National Bureau of Standards, Gaithersburg, Md. Electrosystems Div.
**HIGH VOLTAGE DIVIDER AND RESISTOR CALIBRATIONS Final Report**
M. Misakian Jul. 1985 34 p
(PB86-105715; NBS/TN-1215) Avail: NTIS Avail: SOD HC $1.25 as 003-003-02672-7 CSCL 09A

A calibration service for determining the ratio of high voltage dc dividers and the resistance of high voltage resistors is described. Calibrations are performed with a Wheatstone bridge apparatus with a simple guard system. Sources of systematic error are identified and methods for characterizing the standard high voltage resistors are discussed. Ratio and resistance values can be determined between the voltages of 10 kV and 150 kV with an uncertainty of less than + or 0.01%. E.A.K.

**N86-22617#** Societe Crouzet, Valence (France).
**ADVANCED PRINTED WIRING BOARD (PWB) MATERIALS FOR SURFACE MOUNTED DEVICES IN AEROSPACE APPLICATIONS**
G. Menozzi *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 203-213 refs Sponsored by CNES (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22618#** Du Pont (UK) Ltd., Stevenage (England).
**MULTILAYER PRINTED CIRCUIT BOARD CHARACTERIZATION BY THERMAL ANALYSIS**
J. N. Leckenby *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 215-222 refs Sponsored by International Computers Ltd., Kidsgrove, England and Fortin Industries Inc., Sylmar, Calif. (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22762#** Joint Publications Research Service, Arlington, Va.
**A FAST LEADING-EDGE PULSE GENERATOR Abstract Only**
Rendao Wang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 139 Transl. into ENGLISH from Hedianzixue Yu Tance Jishu (Beijing, China), v. 5, no. 5, Sep. 1985 p 294-297 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22763#** Joint Publications Research Service, Arlington, Va.
**TYPE GDB-110 LARGE AREA, FAST RESPONSE PHOTOMULTIPLIER Abstract Only**
Yonglu Song, Deqi Xu, Biao Yu, and Shou Li *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 140 Transl. into ENGLISH from Hedianzixue Yu Tace Jishu (Beijing, China), v. 5, no. 5, Sep. 1985 p 303-306 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22766#** Joint Publications Research Service, Arlington, Va.
**DIRECTIONS OF TECHNOLOGICAL DEVELOPMENT BY ELECTRIC INDUSTRY**
Keiji Narimatsu *In its* Japan Report: Science and Technology (JPRS-JST-86-006) 18 Mar. 1986 p 47-54 Transl. into ENGLISH from Enerugi Foramu (Tokyo, Japan) Jul. 1985 p 84-87 (For primary document see N86-22764 13-31)
Avail: NTIS HC A04/MF A01

**N86-22768#** Joint Publications Research Service, Arlington, Va.
**EMISSION MECHANISM OF OXIDE CATHODE**
Enqui Zhang *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 63-73 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 2, no. 2, Mar. 1983 p 33-39 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

**N86-22791*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**A SINGLE CHIP VLSI REED-SOLOMON DECODER**
H. M. Shao, T. K. Truong, I. S. Hsu, L. J. Deutsch, and I. S. Reed (University of Southern California) *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 73-81 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 09A

**N86-23246#** Joint Publications Research Service, Arlington, Va.
**MAGNETOPHORE THERAPY**
Igor Mosin *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 54-55 Repr. from Moscow News (Moscow, USSR), no. 36, 15-22 Sep. 1985 p 10 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

## 34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

**N86-22877** Georgia Inst. of Tech., Atlanta.
**LASER DOPPLER DIAGNOSTICS OF THE FLOW BEHIND A BACKWARD FACING STEP Ph.D. Thesis**
Wilhelmus Adrianus deGroot 1985 211 p
Avail: Univ. Microfilms Order No. DA8521246

A detailed investigation of two-dimensional backward facing step flows without and with mass addition from the bottom surface behind the step is reported. Ensemble averages of Laser Doppler Velocimeter measurements were used to obtain the mean velocities and turbulence quantities. Probability density functions constructed from these measurements and acoustic spectra obtained with a microphone probe do not indicate the presence of low frequency oscillations. No intermittency was discovered in the shear layer. It is shown that injection does not have an effect on the length of the reattachment zone and only a small effect on the total size of this zone. It is shown that turbulence quantities inside the recirculation zone exhibit a remarkable decrease with increasing injection. The maxima of these quantities do not markedly change with injection. Maximum Reynolds stresses are considerably higher than the stresses measured by other researchers. Dissert. Abstr.

**N86-22878** Pennsylvania State Univ., University Park.
**COMPUTATION OF INCOMPRESSIBLE FLOW BY A COUPLED IMPLICIT SCHEME Ph.D. Thesis**
Dochul Choi 1985 139 p
Avail: Univ. microfilms Order No. DA8525669

The Linearized Block Alternating-direction implicit (LBI) scheme is studied to obtain steady state solutions of incompressible flow equations in generalized coordinates. The LBI scheme is applied to the incompressible equations by adding an artificial time derivative to the continuity equation. This modification allows both the pressure and velocity to be obtained implicity, in a fully coupled manner. Two dimentional inviscid solutions are attempted in two ways: by applying the LBI scheme to the hyperbolized incompressible equations, and by applying the scheme to preconditioned compressible equations. The preconditioning procedure is developed to achieve rapid convergence at the incompressible limit (low Mach number) of compressible flow equations. This procedure makes the convergence rate independent of Mach number and restores the convergence rates which are characteristic of high subsonic Mach numbers. Converged flowfields from both sets of equations are identical and agree well with those obtained from the Douglas-Neumann program. Stability characteristics of the scheme are carefully studied through Fourier analyses in vector form. Dissert. Abstr.

**N86-22879** Pittsburgh Univ., Pa.
**ASYMMETRIC ROTATING DISK FLOW. A NEW SET OF SOLUTIONS OF THE NAVIER-STOKES EQUATIONS Ph.D. Thesis**
Ching-Yue Lai 1985 168 p
Avail: Univ. Microfilms Order No. DA8524839

Flows occurring between parallel rotating disks have recently been generalized by Parter and Rajagopal (1984) to include solutions that are not axisymmetric. They prove the existence of a one-parameter family of solutions for flows between two disks rotating about either a common axis or distinct axes. In light of the foregoing, one is advised to re-examine the classical problems of flow between two rotating disks and over a single rotating disk within the context of the establishing asymmetric solutions numerically. The Galerkin's method using B-splines are trial functions was used to solve for the basic flow and for the stability of the basic flow to infinitesimal disturbances. The flow between infline parallel disks appears to have multiple solutions (Holodniok, et. al., (1981)). In the classical Karman problem, each of these solutions give rise to an infinite number of asymmetric solutions. rotations about common axis and distinct axes were assumed in the calculation of asymmetric two disk flows. Dissert. Abstr.

**N86-22880** California Univ., Berkeley.
**RADIATIVE-CONVECTIVE HEAT TRANSFER TO SOLID SPHERICAL PARTICLES IN A VERTICAL CHANNEL FLOW Ph.D. Thesis**
Joon Sik Lee 1985 151 p
Avail: Univ. Microfilms Order No. DA8525030

A numerical study has been conducted pertaining to the problem of radiative convective heat transfer to solid spherical particles in a vertical channel flow. The gas phase is treated within the context of an Eulerian (continuum) formulation. For the particulate phase, a Lagrangian approach has been employed that includes two-way coupling of momentum and heat transfer between phases. The gas flow is in laminar regime and the particle Reynolds number based on the particle radius and skip velocity between phases is of order one. The particulate phase is dilute enough that direct particle, particle interactions are negligible but particle volume fraction effects are retained in the transport equations for the gas phase. The particle and channel wall surfaces are taken as diffusely emitting and reflecting. For the particulate phase, radiative heat transfer is directly coupled with convective heat transfer through the energy conservation equation and for the walls, through the thermal boundary condition. Dissert. Abstr.

**N86-22881** Cornell Univ., Ithaca, N.Y.
**SOME PROBLEMS OF HYDRODYNAMIC STABILITY ARISING IN GEOPHYSICAL FLUID DYNAMICS Ph.D. Thesis**
Sanjiva Keshava Lele 1985 328 p
Avail: Univ. Microfilms Order No. DA8525778

Two problems of hydrodynamic instability are considered. One concerns the linear and nonlinear dynamics of Langmuir circulations in the ocean arising from the stabilizing influence of current shear and wave action. The second considers instabilities of geophysical Ekman layers. The theoretical model of Leibovich (1977a) is used to investigate the influence of the thermal environment on Langmuir circulations. Stable stratification is found to limit both the strength and the vertical penetration of the circulation: strong thermoclines act as a virtual bottom. Linear stability characteristics for the finite layer problems with various combinations of mechanical and thermal boundary conditions are obtained numerically. Limit cases of interest are treated analytically, a case of particular interest establishes an analogy between Langmuir circulations and Marangoni convection. The nonlinear physics of Langmuir circulations is studied with carefully chosen finite difference simulations. Even with weak stable stratification the onset of steady circulations is subcritical. As the stratification is increased two classes of steady states differing in spatial form arise, one of which is generally unstable. Dissert. Abstr.

**N86-22882** Iowa State Univ. of Science and Technology, Ames.
**A BOUNDARY LAYER COMPUTATIONAL MODEL FOR PREDICTING THE FLOW AND HEAT TRANSFER IN SUDDEN EXPANSIONS Ph.D. Thesis**
Jeffrey P. Lewis 1985 232 p
Avail: Univ. Microfilms Order No. DA8524673

Fully developed turbulent and laminar flows through symmetric planar and axisymmetric expansions with heat transfer were modeled using a finite-difference discretization of the boundary-layer equations. By using the boundary-layer equations to model separated flow in place of the Navier-Stokes equations, computational effort was reduced permitting turbulence modeling studies to economically carried out. The continuity and momentum equations were solved in a coupled matter. For laminar constant property flow, the equations were nodimensionalized so that the solution was independent of Reynolds number. Two different dependent hydrodynamic variable sets were tried: the primitive variable set (u-v), and the streamwise velocity steam function variable set (u-psi). The predictions of the boundary-layer equations for parameters associated with the trapped eddy compared well with the predictions of the Navier-Stokes equations and experimental measurements for laminar isothermal flow.
Dissert. Abstr.

**N86-22883** Illinois Univ., Chicago.
**CONJUGATE MIXED CONVECTION-CONDUCTION HEAT TRANSFER IN POROUS MEDIA Ph.D. Thesis**
Jin-Yuan Lin 1985 251 p
Avail: Univ. Microfilms Order No. DA8524812

This dessertation studies analytically the conjugate mixed-convection conduction heat transfer in porous media. Solutions for mixed convection flows about vertical plate and cylindrical fins embedded in a porous medium have been obtained by including the effects of interactions between the conduction in the solid boundaries (fins) and the convection in the boundary layer. It has been found that the governing parameters are the Prandtl number Pr, buoyancy force parameter Omega, convection conduction parameter Ncc, and the surface curvature parameter lambda. Extensive results for heat transfer characteristics are presented graphically and in tabular forms for the following ranges of parameters: $0.05 < \text{or} = Pr < \text{or} = 7.5$, $0.0 < \text{or} = \text{omega} < \text{or} = 20.0$, $0.0 < \text{or} = Ncc\ 2.0$ and $0.5 < \text{or} = \text{lambda} < \text{or} = 5.0$. Many results were found to have trends similar to those for classical fluids. In particular, the local heat transfer coefficients for mixed convection flows were found not to decrease monotonically as usual, but instead, the coefficients decreased first, attained a minimum value and then increased with increasing streamwise distance. This behavior is attributable to an enhanced buoyancy force resulting from an increase in the wall-to-fluid temperature difference along the streamwise direction. Dissert. Abstr.

**N86-22884** Delaware Univ., Newark.
**BUOYANCY EFFECT ON MIXING FLOW Ph.D. Thesis**
Krishnamurthy Muralidhar 1985 281 p
Avail: Univ. Microfilms Order No. DA852581

The physical problem of two parallel streams of a fluid coming in contact is considered here. A whole class of flows arising from the velocity ratio as the parameter were identified. The physical mechanisms which come into play in low Reynolds number flow as it proceeds from laminar to turbulent state via hydrodynamic instability were studied. Flow modification arising from buoyancy and streamline curvature are examined. Numerical and experimental techniques were employed in the analysis. Turbulence was included by a kinetic energy-dissipation model. Experiments involve hot wire measurements of mean flow and turbulent fluctuations.
Dissert. Abstr.

**N86-22885** Iowa State Univ. of Science and Technology, Ames.
**MEASUREMENTS OF THE FLOW AND THERMAL CHARACTERISTICS OF TURBULET JETS IN CROSS FLOW Ph.D. Thesis**
Sherif Ahmed Sherif 1985 547 p
Avail: Univ. Microfilms Order No. DA8524692

An experimental investigation of the flow, turbulence, and thermal characteristics of heated, cooled, and isothermal turbulent jets in cross flow is reported. The experiments were carried out in a water channel facility of the recirculation type. Hot or cold water was injected verically upward from a circular pipe located near the channel bottom to the cross-flowing stream in the channel. Hot and cold-film anemometers along with appropriate linearizers, bridges, filters, and probes were used. A new signal analysis method was developed for resolving the complex three-dimensional structure of the mean turbulent flow field resulting from the interaction between the free stream and the jet. A rotatable probe technique was used to measure the size components for the Reynolds stress tensor in isothermal flows of any turbulence intensity. New experssions that correct for the temperature contamination of the velocity signals in nonisothermal flows were developed for both the linearized and unlinearized anemometer responses. Mean velocity and turbulence intensity data were obtained for the isothermal jet at jet-to-free stream velocity ratios of 2, 4, and 6 both in and outside the jet plane of symmetry.
Dissert. Abstr.

**N86-22886** British Library Lending Div., Boston Spa (England).
**MATHEMATICAL MODEL OF LIQUID-PHASE CARRY-OFF FROM A GAS-AGITATED LAYER**
N. K. Nikolaenko and G. S. Sborshchikov 1985 8 p refs Transl. into ENGLISH from Izv. VUZ Chernaya Metallurgiya (USSR), (no. 7), 1985 p 139-141
(BLL-M-36589-(5828.4)) Avail: British Library Lending Div., Boston Spa, England

A mathematical model is presented of a two dimensional stationary isobaric two phase jet, the flow being symmetrical about the longitudinal axis of the jet. It enables the mutual effects of liquid drops entrained in gas bubbled through a liquid bath, and the gas itself to be allowed for in calculations of the carry off of liquid in such processes.
Author

**N86-22887** National Physical Lab., Teddington (England). Div. of Materials Applications.
**ASPECTS OF FLUID FLOW OF RELEVANCE TO CORROSION FATIGUE AND STRESS CORROSION CRACKS**
P. F. Easthope (British Maritime Technology Ltd.) and A. Turnbull Jul. 1985 42 p refs
(NPL-DMA(A)-105; ISSN-0143-7313) Copyright. Avail: Issuing Activity

Experimental evidence for an effect of bulk fluid flow on crack chemistry and crack propagation rates prompted an analysis of the flow caracteristics associated with cracks. Flow along or across the crack mouth; flow through the crack; flow directed into a surface crack; and flow induced by cyclic displacement of the crack walls (as in a fatigue situation) were studied. The important characteristic parameters, dimensionless variables, and hydrodynamic equations are established. Model solutions from the literature are discussed. The effect on crack chemistry of flow of the bulk solution is predicted to be most significant for shallow cracks and for configurations in which the flow is directed into a surface crack or into an edge-crack in which the crack sides are open. Experimental evidence for the effect of bulk flow rate on crack chemistry and crack growth, though limited, supports the conclusions.
Author (ESA)

**N86-22888#** National Aerospace Lab., Tokyo (Japan).
**NON-STEADY FLOW FIELD OF TWO-DIMENSIONAL SUPERSONIC NOZZLES**
Noboru Abe 1985 15 p refs In JAPANESE; ENGLISH summary
(NAL-TR-855; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

The non-steady flow field of an impulsively started dimensional nozzle was investigated, using double exposure interferometry. Two straight nozzles, one with a sharp-edged throat and the other with a rounded throat, were inserted into a 60mm x 150mm cross sectional shock tube. Incident shock Mach numbers were 2.0 and 2.4 in air. Continuous monitoring of wave interactions, incident shock, secondary shock, Mach stem, and slip line, were carried out using a streak camera technique. Time-wise development of the density distribution of the whole flow field showed a detailed structure of the starting process and the wave interactions. The steady flow field upstream of secondary shock obtained by the experiment was compared with a numerical calculation using a finite difference method with a shock capturing procedure. Very good agreement between them was obtained. Double exposure holographic interferometry provides a useful tool for generating a gas dynamic data base for evaluation of numerical calculations.
Author

**N86-22889*#** Bucknell Univ., Lewisburg, Pa.
**HYDRODYNAMIC ASPECTS OF SHARK SCALES Contractor Report, 1982 -1983**
William G. Raschi and John A. Musick (Coll. of William and Mary, Gloucester Point, Va.) Mar. 1986 117 p refs
(Contract NAS1-16042)
(NASA-CR-3963; NAS 1.26:3963) Avail: NTIS HC A06/MF A01 CSCL 20D

Ridge morphometrices on placoid scales from 12 galeoid shark species were examined in order to evaluate their potential value for frictional drag reduction. The geometry of the shark scales is similar to longitudinal grooved surfaces (riblets) that have been previously shown to give 8 percent skin-friction reduction for turbulent boundary layers. The present study of the shark scales was undertaken to determine if the physical dimensions of the ridges on the shark scales are of the right magnitude to be used by the sharks for drag reduction based on previous riblet work. The results indicate that the ridge heights and spacings are normally maintained between the predicted optimal values proposed for voluntary and burst swimming speeds throughout the individual's ontogeny. Moreover, the species which might be considered to be the faster posses smaller and more closely spaced ridges that based on the riblet work would suggest a greater frictional drag reduction value at the high swimming speeds, as compared to their more sluggish counterparts.
Author

**N86-22890*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EXPERIMENTAL VERIFICATION OF CORROSIVE VAPOR DEPOSITION RATE THEORY IN HIGH VELOCITY BURNER RIGS**
Suleyman A. Gokoglu (Case Western Reserve Univ., Cleveland, Ohio) and Gilbert J. Santoro 1986 12 p refs Presented at 3rd Conference on High Temperature Alloys for Gas Turbines and Other Applications, Liege, Belgium, 6-9 October 1986; sponsored by Commission of the European Communities
(NASA-TM-87287; E-2993; NAS 1.15:87287) Avail: NTIS HC A02/MF A01 CSCL 20D

The ability to predict deposition rates is required to facilitate modelling of high temperature corrosion by fused salt condensates in turbine engines. A corrosive salt vapor deposition theory based on multicomponent chemically frozen boundary layers (CFBL) has been successfully verified by high velocity burner rig experiments. The experiments involved internally air-impingement cooled, both rotating full and stationary segmented cylindrical collectors located in the crossflow of sodium-seeded combustion gases. Excellent

agreement is found between the CFBL theory an the experimental measurements for both the absolute amounts of Na2SO4 deposition rates and the behavior of deposition rate with respect to collector temperature, mass flowrate (velocity) and Na concentration. Author

**N86-22891*#** Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
**COUPLING BETWEEN FLUID DYNAMICS AND ENERGY ADDITION IN ARCJET AND MICROWAVE THRUSTERS Final Technical Report, 1 Feb. 1985 - 1 Jan. 1986**
Michael M. Micci 7 Apr. 1986 47 p refs
(NASA-CR-176690; NAS 1.26:176690) Avail: NTIS HC A03/MF A01 CSCL 20D

A new approach to numerically solving the problem of the constricted electric arcjet is presented. An Euler Implicit finite difference scheme is used to solve the full compressible Navier Stokes equations in two dimensions. The boundary and initial conditions represent the constrictor section of the arcjet, and hydrogen is used as a propellant. The arc is modeled as a Gaussian distribution across the centerline of the constrictor. Temperature, pressure and velocity profiles for steady state converged solutions show both axial and radial changes in distributions resulting from their interaction with the arc energy source for specific input conditions. The temperature rise is largest at the centerline where there is a the greatest concentration arc energy. The solution does not converge for all initial inputs and the limitations in the range of obtainable solutions are discussed. Author

**N86-22892*#** Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
**HEAT TRANSFER TO TWO-PHASE AIR/WATER MIXTURES FLOWING IN SMALL TUBES WITH INLET DISEQUILIBRIUM Final Report**
J. M. Janssen, L. W. Florschuetz, and J. P. Fiszdon Mar. 1986 100 p refs
(Grant NsG-3075)
(NASA-CR-175076; NAS 1.26:175076) Avail: NTIS HC A05/MF A01 CSCL 20D

The cooling of gas turbine components was the subject of considerable research. The problem is difficult because the available coolant, compressor bleed air, is itself quite hot and has relatively poor thermophysical properties for a coolant. Injecting liquid water to evaporatively cool the air prior to its contact with the hot components was proposed and studied, particularly as a method of cooling for contingency power applications. Injection of a small quantity of cold liquid water into a relatively hot coolant air stream such that evaporation of the liquid is still in process when the coolant contacts the hot component was studied. No approach was found whereby heat transfer characteristics could be confidently predicted for such a case based solely on prior studies. It was not clear whether disequilibrium between phases at the inlet to the hot component section would improve cooling relative to that obtained where equilibrium was established prior to contact with the hot surface. Author

**N86-22893*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**NON-REFLECTING BOUNDARY CONDITIONS FOR THE COMPRESSIBLE NAVIER-STOKES EQUATIONS Final Report**
Saul Abarbanel (Tel-Aviv Univ.), Alvin Bayliss (Exxon Corp. Research Science Labs.), and Liviu Lustman Mar. 1986 28 p refs Presented at the 7th International Conference on Computing Methods in Applied Sciences and Engineering, Versailles, France, 9-13 Dec. 1985
(Contracts NAS1-17070; NAS1-18107; Grant AF-AFOSR-0136E-82)
(NASA-CR-178068; ICASE-86-9; NAS 1.26:178068) Avail: NTIS HC A03/MF A01 CSCL 20D

A small perturbation analysis, in the long wavelength regime, is used to obtain the downstream boundary condition for the pressure for the flow over a flat plate. The methodology is extendable to other geometries. Numerical results for high Reynolds number laminar flows show great improvement in convergence rate to steady state as well as the quality of the results. Author

**N86-22894#** Texas Technological Univ., Lubbock. Dept. of Mechanical Engineering.
**THE INFLUENCE OF FLUID MECHANICS ON THE BEHAVIOR OF GAS-BLOWN SPARK GAP SWITCHES Final Report, 30 Sep. 1982 - 31 Jan. 1985**
Herbert J. Carper, Jr. and Timothy T. Maxwell 29 Mar. 1985 76 p
(Grant AF-AFOSR-0327-82)
(AD-A161298; AFOSR-85-0903TR) Avail: NTIS HC A05/MF A01 CSCL 09/1

A research facility was designed and constructed to conduct experiments to determine the influence of fluid mechanics on the performance of gas-blown spark gap switches. The effects of gas flow velocity, electrode divergence angle and hydrodynamic boundary layer development were investigated for laminar flow in a switch consisting of a pair of electrodes mounted in a diverging nozzle configuration. The results of the experiments show that for a given set of operating conditions, a threshold gap velocity exists, and increasing the velocity above this value results in no improvement in switch performance. This threshold velocity is exponentially dependent on the electrode divergence angle, an increase in the latter resulting in a lower threshold velocity. The threshold velocity was found to vary nonmonotonically with the degree of hydrodynamic boundary layer development at the point of minimum gap spacing, and for the conditions investigated there is an optimum hydrodynamic entry length that results in a minimum threshold velocity. The effects of turbulence were investigated briefly with the results showing an improvement in switch performance with turbulence. A numerical model was developed to predict the transient gas density distribution produced in the flow by the arc. The results of the model prediction are compared with interferograms obtained during the experiments. GRA

**N86-22895#** Department of the Air Force, Washington, D.C.
**HYDRAULIC PRESSURE INTENSIFIER Patent Application**
Robert S. Andrews, inventor (to Air Force) Filed 1 Oct. 1985 12 p
(AD-D012008; US-Patent-Appl-SN-782630) Avail: NTIS HC A02/MF A01 CSCL 13/7

A hydraulic pressure intensifier is used to raise the pressure in an accumulator above a given input pressure. An oscillating piston provides a boost pressure while a pilot valve and a dump valve and restrictors allow the oscillating piston to move.
Author (GRA)

**N86-22896#** National Bureau of Standards, Washington, D.C. Center for Building Technology.
**VALIDATION TEST OF AN EARTH CONTACT HEAT TRANSFER ALGORITHM**
G. N. Walton Oct. 1985 33 p
(Contract DE-AI01-76PR-06010)
(DE86-001897; NBSIR-85/3291) Avail: NTIS HC A03/MF A01

Experimental tests and numerical calculations are performed to determine the suitability of including a simplified earth contact heat transfer algorithm in building energy analysis computer simulations. There is very good agreement between the floor surface temperature of the NBS Passive Solar Test Facility and the temperature predicted by the test program. These results indicate that simplifications based upon the specific configuration can give good results for a simple calculation of the annual earth contact heat flux. There may be considerable differences in the hourly and daily heat flux values when the actual weather departs from the annual harmonic approximation of the simple method. It is recommended that any algorithm used in a large building energy analysis computer program include the capability of modeling the specific geometry under consideration instead of (or in addition to) using tables of coefficients which have been generated for a manual method. The algorithm should also include the ability to handle the same weather data that is used in the energy analysis. DOE

**N86-22897#** California Univ., Berkeley. Lawrence Berkeley Lab.
**DETAILED NUMERICAL, GRAPHICAL, AND EXPERIMENTAL STUDY OF OBLIQUE-SHOCK-WAVE REFLECTIONS**
H. M. Glaz, P. Colella, I. I. Glass, and R. L. Deschambault Apr. 1985 384 p refs
(Contract DE-AC03-76SF-00098)
(DE86-002005; LBL-20033) Avail: NTIS HC A17/MF A01

An extensive series of numerical calculations of oblique-shock-wave reflections in air and argon have been performed using a version of the second-order Eulerian Godunov scheme for inviscid compressible flow. The results have been compared with the best available interferometric data from the UTIAS 10 cm x 18 cm shock tube, for fifteen different cases. The objective of this portion of the study was to assess the accuracy of the computer code in computing two-dimensional shocked flow of an inviscid perfect gas. The analysis is devoted to the question of the extent of influence of viscous and vibrational nonequilibrium effects on the experimental flow fields. Further parametrized series of calculations were performed in an effort to study the feasibility of numerically constructing inviscid transition lines in the (M(sub s), theta(sub w))-plane. Good agreement with analytic predictions was found for low values of M(sub s) and, as might be expected, there are substantial discrepancies for M(sub s) = 8.75. The possibility of using such numerical results in the formulation of accurate transition criteria is discussed. DOE

**N86-22898#** United Technologies Research Center, East Hartford, Conn.
**DEVELOPMENT OF LASER DRILLING TECHNIQUES TO FABRICATE CERAMIC DISTRIBUTOR PLATES Report, 15 Aug. 1984 - 15 Jun. 1985**
D. H. Polk Aug. 1985 62 p refs
(Contract DE-AC07-84ID-12537)
(DE86-002297; DOE/ID-12537/1) Avail: NTIS HC A04/MF A01

Fluidized bed heat exchangers (FBHEX) offer the potentially cost effective recovery of high temperature waste heat from the 2000 to 3000F flue gases of many industrial processes. Such applications will require FBHEX distributor plates of ceramics that will withstand the high temperature and corrosive environment, and fabrication of the required perforated ceramic plates of 3 to 10% open area with holes as small as 0.01-in. in dia is not generally possible with conventional ceramic fabrication techniques. Laser drilling is examined as a means for producing the required closely spaced arrays of small holes or slots in selected ceramics. Silicon carbide, silicon nitride, 85% alumina, and a SiC fiber composite were all successfully drilled with 3% open area arrays of 0.01-in. dia holes, 0.06-in. dia holes, and 0.01 x 0.06-in. slots and with no loss of strength except from section area reduction and stress concentrations. For potential mass production systems, drilling costs were estimated to be $120-620/sq ft. The lower costs appear economically viable, and improvements appear possible with further development of the drilling process. DOE

**N86-22899#** Argonne National Lab., Ill.
**EXPERIMENTAL OPERATION OF A SODIUM HEAT PIPE**
R. E. Holtz, G. A. McLennan, and E. R. Koehl May 1985 55 p refs
(Contract W-31-109-eng-38)
(DE86-002550; ANL-85-61) Avail: NTIS HC A04/MF A01

This report documents the operation of a 28 in. long sodium heat pipe in the Heat Pipe Test Facility (HPTF) installed at Argonne National Laboratory. Experimental data were collected to simulate conditions prototypic of both a fluidized bed coal combustor application and a space environment application. Both sets of experiment data show good agreement with the heat pipe analytical model. The heat transfer performance of the heat pipe proved reliable over a substantial period of operation and over much thermal cycling. Additional testing of longer heat pipes under controlled laboratory conditions will be necessary to determine performance limitations and to complete the design code validation. DOE

**N86-22900#** Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
**SOLIDS CIRCULATION PATTERN AND PARTICLES MIXING IN A LARGE JETTING FLUIDIZED BED**
W. C. Yang, B. Ettehadieh, and G. B. Haldipur 1985 32 p Presented at the American Institute of Chemical Engineers Annual Winter Meeting, Chicago, Ill., 10 Nov. 1985 Prepared in cooperation with KRW Energy Systems, Inc., Madison, Pa.
(Contract DE-AC21-84MC-21063)
(DE86-001655; CONF-851123-4) Avail: NTIS HC A03/MF A01

Macroscopic behavior of solids circulation in a large jetting fluidized bed was surveyed with a force probe. Particles mixing was studied by pulse injection of tracer particles and a simple mechanistic model was developed on the basis of the solids circulation patterns observed. The model compares favorably with experimental tracer concentration profiles. DOE

**N86-22901#** Oak Ridge National Lab., Tenn.
**VISUALIZATION OF FLOW FIELDS AND INTERFACIAL PHENOMENA IN LIQUID-LIQUID SOLVENT EXTRACTION**
T. C. Scott 1985 17 p refs Presented at the 4th Symposium on Separation Science and Technology for Energy Applications, Knoxville, Tenn., 20 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002224; CONF-851011-5) Avail: NTIS HC A02/MF A01

Use of a video camera apparatus with a helium-neon laser light source has enabled the detection of flow fields in and around a circulating aqueous droplet which is suspended in a flowing stream of 2-ethyl-1-hexanol. Droplet Reynolds numbers were in the range of 7 to 22. The behavior of the streamlines for flow both inside and outside the droplet was shown to be similar to that predicted for circulating droplets at low Reynolds numbers. Formation of stagnant caps of surfactant at the rear of the droplets was found to suppress the flow patterns inside the droplet and decrease the associated internal fluid velocities. DOE

**N86-22902#** California Univ., Berkeley. Lawrence Berkeley Lab.
**HEAT DIFFUSION SOLUTIONS FOR THE NONRESONANT SPECTROPHONE**
R. Gerlach and N. M. Amer Jun. 1985 5 p ref Presented at the 4th International Topical Meeting on Photoacoustic, Thermal and Related Sciences, Quebec, Canada, 4 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002883; LBL-20188; CONF-850886-2) Avail: NTIS HC A02/MF A01

Analytic heat diffusion solutions for compressible gas in cylindrical cells for Gaussian and arbitrary beam profiles are compared to standard (neglecting compressibility) heat diffusion equation solutions. DOE

**N86-22903#** Argonne National Lab., Ill.
**FLUID EXCITATION FORCES ACTING ON A TUBE ARRAY**
S. S. Chen and J. A. Jendrzejczyk Sep. 1985 63 p
(Contract W-31-109-eng-38)
(DE86-003441; ANL-85-55) Avail: NTIS HC A04/MF A01

Fluid forces are important in the assessment of vibration of the Space Shuttle Main Engine liquid oxygen posts. This report summarizes the available data on fluid excitation forces acting on tube arrays in turbulent crossflow, and test results for an array of tubes subject to turbulent flow. The fluctuating drag and lift forces are measured as a function of Reynolds number, incoming flow conditions, and tube location in an array. DOE

**N86-22904#** Argonne National Lab., Ill.
**ANALYSIS WITH THE 3-D COMMIX CODE**
1985 17 p Presented at the National Heat Transfer Conference, Denver, Colo., 4 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-006836; CONF-850810-8) Avail: NTIS HC A02/MF A01

A 3-D COMMIX model was set up to simulate the 1/7-scale Westinghouse natural convection test. The COMMIX model included the upper plenum, core, lower plenum, two hot legs, and two steam generators. The pressurizer tee was modeled as an

exit surface with continuous-mass-flow boundary condition. A total of 1464 computational cells and 81 surfaces were used for the COMMIX model. Three layers of vertical cells were used to model the hot leg. This model allows for reasonably accurate modeling of the countercurrent flows in the hot legs. The heat exchangers in the upper plenum and the steam generators were modeled by two-sided thermal structures. Thermal capacity of all the structures was modeled throughout the systems according to the physical dimensions and properties of the system. Volume porosity and surface porosities were calculated and used in the COMMIX model throughout the computational domain to correctly simulate the structures in the experiment. Results of the COMMIX calculations based on these models were compared with the experimental measurements. DOE

**N86-22905#** Mound Lab., Miamisburg, Ohio. Mound.
**MEASUREMENT OF PYROTECHNIC IGNITION ENERGY BY THERMOGRAPHY**
J. H. Mohler, L. D. Abney, and T. S. Chow 1985 7 p Presented at the 8th Thermosense Conference, Cambridge, Mass., 16 Sep. 1985 Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(Contract DE-AC04-76DP-00053)
(DE86-001754; MLM-3299(OP); CONF-8509181-2) Avail: NTIS HC A02/MF A01

Measuring the laser energy required to ignite pyrotechnic pellets is complicated by several factors that are difficult to control or predict. These include reflection of part of the incident laser energy, reemission from the heated sample, and heat conduction away from the ignition site. In addition to these factors, it is often difficult to control and/or measure the incident laser power. High-speed thermographic recording of the temperature distribution in the test sample makes it possible to calculate the heat content of the test pellet at any instant. Thus, one can actually observe the laser heating and on-set of reaction in the pellet and avoid having to make measurements or assumptions to account for possible energy losses. DOE

**N86-22906#** Lawrence Livermore National Lab., Calif.
**APPLICATION OF HARDY'S MULTIQUADRIC INTERPOLATION TO HYDRODYNAMICS**
E. J. Kansa Oct. 1985 8 p refs Presented at the Society for Computer Simulation Multiconference, San Diego, Calif., 23 Jan. 1986
(Contract W-7405-eng-48)
(DE86-001906; UCRL-93522; CONF-860119-2) Avail: NTIS HC A02/MF A01

Hardy's multiquadric interpolation (MQI) scheme is a global, continuously differentiable interpolation method for solving scattered data interpolation problems. It is capable of producing monotonic, extremely accurate interpolating functions, integrals, and derivatives. Derivative estimates for a variety of one and two-dimensional surfaces were obtained. MQI was then applied to the spherical blast wave problem of von Neumann. The numerical solution agreed extremely well with the exact solution. DOE

**N86-22907#** Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics.
**A TIME DEPENDENT FREE BOUNDARY GOVERNED BY THE NAVIER-STOKES EQUATIONS**
C. Cuvelier 1985 9 p refs Repr. from Physica (Netherlands), v. 218 p 170-174 Presented at 9th International Conference on Numerical Methods in Fluid Dynamics, Saclay, France, 25-29 Jun. 1984 Submitted for publication
(Rept-85-07) Avail: NTIS HC A02/MF A01

A two dimensional linearized nonstationary capillary free boundary problem governed by the Navier-Stokes equations is studied. A liquid in a smooth walled container subject to gravity is considered. The fluid is isothermal, incompressible, newtonian, with constant density, viscosity, and surface tension coefficient. Under these assumptions the equations of nonstationary motion, which are the equations for conservation of momemtum and mass, reduce to the Navier-Stokes equations for the velocity and pressure. The effects of small perturbations are analyzed. Author (ESA)

**N86-22908#** Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
**COMPUTATIONAL FLUID DYNAMICS AND ITS APPLICATION TO LIQUID-ATOMIZATION AND SPRAY SYSTEMS**
D. Brian Spalding Apr. 1985 45 p refs Lecture presented at ICLASS 1985, London, England, 1985
(CFD/85/3) Avail: NTIS HC A03/MF A01

The applicability of computational fluid dynamics to liquid-atomization and spray (LAS) systems is reviewed. While the computer simulation of many LAS phenomena presents difficulties that cannot yet be overcome, flows on or in a spinning-disk, spinning-cup, impinging-jet, swirl and diesel atomisers; and small-scale phenomena such as the impingement of a droplet on a wall, or the collision of two drops are suitable for computerized simulation. Aspects of LAS systems which must be handled by statistical methods are discussed. Three idealizations are described. It is suggested that a combination of two of the idealizations may permit realistic modeling of the ignition and burn-out processes undergone by fuel sprays. Author (ESA)

**N86-22909#** Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
**A TURBULENCE MODEL FOR BUOYANT AND COMBUSTING FLOWS**
D. Brian Spalding Jul. 1985 21 p Lecture presented at NMTP4 1985, Swansea, Wales, 15-18 Jul. 1985
(CFD/85/10) Avail: NTIS HC A02/MF A01

Turbulent mixing and unmixing, including Rayleigh-Taylor and other instabilities are discussed. A two-fluid model of turbulence, and its relation to Prandtl's mixing-length hypothesis are outlined. Couette flows with and without curvature; channel flow with and without heating; and a combustion example are considered. The two-fluid model can be regarded as an extension of Prandtl's concept to include pressure-gradient-induced sifting. Unlike Prandtl, the model is not forced to replace differential equations by algebraic ones. Initial findings are encouraging: phenomena are explained which conventional turbulence models cannot comprehend, e.g., negative viscosity, flame-turbulence interactions. Author (ESA)

**N86-22910#** Institute of Oceanographic Sciences, Wormley (England).
**WAVE-CURRENT INTERACTIONS: A REVIEW OF SOME PROBLEMS**
M. A. Srokosz 1985 33 p refs Sponsored by UK Department of Energy
(IOS-212) Avail: NTIS HC A03/MF A01

Methods for calculating the interaction of water waves with a vertically varying current which is steady and uniform in the horizontal plane are assessed using experimental evidence on wave-current interactions. It is shown that the effect of current shear is important in determining the kinematics for the waves. Linear superposition of waves and currents is generally inadequate to describe their interaction. Doppler shift in wave frequency due to the current should be allowed for. For small amplitude waves, perturbation theory gives good agreement with laboratory measurements. For finite amplitude waves further comparisons between theory and experiment need to be carried out to check the theoretical results. The correct specification of the current profile in the calculations needs to be investigated. Author (ESA)

**N86-22911#** European Space Agency, Paris (France).
**UNSTEADY THREE-DIMENSIONAL LIFTING SURFACE THEORY WITH THE FREE-SURFACE EFFECT**
Jacques Leclerc and Pierre Salauen Oct. 1985 235 p refs Transl. into ENGLISH of "Theorie Lineaire des Forces Hydrodyn. Instationnaires sur une Surface Portante. Cas Supercritique" Rept. ONERA-P-1984-1 ONERA, Paris, France, 1984 Original language document was announced as N86-17683
(ESA-TT-933; ONERA-P-1984-1) Avail: NTIS HC A11/MF A01

The unsteady three-dimensional linearized lifting surface

problem with the free surface effect is solved in a supercritical case using the integral equation method. The kernel originating in the potential of Havelock source is expressed as a Fourier series with respect to the azimuth angle, the coefficients of which are simple integrals. The method of steepest descents provides asymptotic approximations for coefficients of large indices. It is shown that convergence disappears on the free surface downstream from the integration point. An asymptotic approximation for the remainder of the truncated series is used to find the singularity. The integral equation yielding the local lift coefficient is solved by a collocation method. Curves showing the numerical results for horizontal and vertical vibrating plates moving horizontally enable the ranges of the parameters over which the free-surface effects on the hydrodynamic derivatives are significant to be determined. Author (ESA)

**N86-22912#** European Space Agency, Paris (France).
**STEADY LIFTING SURFACE THEORY WITH A FREE SURFACE**
Jacques Leclerc and Pierre Salauen Nov. 1985 46 p refs Transl. into ENGLISH of "Probleme Portant Stationnaire avec Effet de la Surface Libre" Rept. ONERA-P-1984-2 ONERA, Paris, France, 1984 Original language document was announced as N86-17684 (ESA-TT-934; ONERA-P-1984-2) Avail: NTIS HC A03/MF A01

Steady lifting surface theory with a free surface is developed by an integral equation method. The local lift coefficient appears as a solution to an integral equation of the first kind whose kernel, deduced from a Havelock source potential, is expanded in a Fourier series with respect to the azimuth angle. The coefficients of this series are definite integrals. The method of steepest descents gives asymptotic approximations to coefficients of large index terms, and the remainder can be evaluated approximately in all cases. Numerical applications such as the calculation of the lift and drag for a lifting wing, and the hydrodynamic pressures arising from the turn of a ship are given. Author (ESA)

# 35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

**N86-22913** British Library Lending Div., Boston Spa (England).
**NEW THERMOCOUPLE PROBE FOR INVESTIGATING TEMPERATURE FIELDS IN BLAST FURNACES**
I. W. Elke, G. Yu. Voronin, A. G. Ulyanov, and G. A. Polevoi 1985 7 p refs Transl. into ENGLISH from Stal. (USSR), no. 7, 1985 p 6-10
(BLL-M-36566-(5828.4)) Avail: British Library Lending Div., Boston Spa, England

A design of thermocouple probes for measuring temperatures of up to 1200 C along a radius of the blast-furnace stack is described. The probe takes 3 min or less to complete the set of radial measurements, has a low inertia and high sensitivity and operates reliably in large furnaces. Author

**N86-22914*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**AN INTEGRATED DEVELOPMENT FACILITY FOR THE CALIBRATION OF LOW-ENERGY CHARGED PARTICLE FLIGHT INSTRUMENTATION Center Director's Discretionary Fund, Final Report**
Alan P. Biddle and John M. Reynolds Oct. 1985 24 p refs
(NASA-TM-86526; NAS 1.15:86526) Avail: NTIS HC A02/MF A01 CSCL 14B

A system was developed for the calibration and development of thermal ion instrumentation. The system provides an extended beam with usable current rates, approx. 1 pA/sq cm, at beam energies as low as 1 eV, with much higher values available with increasing energy. A tandem electrostatic and variable geometry magnetic mirror configuration within the ion source optimizes the use of the ionizing electrons. The system is integrated under microcomputer control to allow automatic control and monitoring of the beam energy and composition and the mass and angle-dependent response of the instrument under test. The system is pumped by a combination of carbon vane and cryogenic sorption roughing pumps and ion and liquid helium operating pumps. E.A.K.

**N86-22915*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**THE DETERMINATION OF THE DIRECTION OF THE OPTIC AXIS OF UNIAXIAL CRYSTALLINE MATERIALS**
James A. Lock (Cleveland State Univ., Ohio), Harold J. Schock, and Carolyn A. Regan Apr. 1986 21 p refs
(NASA-TM-86892; E-2364; NAS 1.15:86892) Avail: NTIS HC A02/MF A01 CSCL 20F

The birefringence of crystalline substances in general, and of sapphire in particular, is described. A test is described whose purpose is to determine the direction of the optic axis of a cylindrically machined single crystal of sapphire. This test was performed on the NASA Lewis sapphire cylinder and it was found that the optic axis made an angle of 18 deg with the axis of symmetry of the cylinder. Author

**N86-22916#** Department of the Air Force, Washington, D.C.
**TRANSIENT DETECTOR APPARATUS Patent Application**
Lapeyrolerie, inventor (to Air Force) Filed 8 Aug. 1985 45 p
(AD-D012005; US-Patent-Appl-SN-763578) Avail: NTIS HC A03/MF A01 CSCL 09/4

A transient detector apparatus utilizing peak and slope detectors to determine the presence of transient signal in a logic signal. Individual slope measurements of the input signal are compared with a logic criteria to establish the occurrence of a transient. The peak voltage and pulse width of a transient are digitized in order to time tag or isolate a transient to a particular signal. GRA

**N86-22917#** EG and G Energy Measurements, Inc., Goleta, Calif.
**MERCURIC IODIDE X-RAY CAMERA**
B. E. Patt, A. DelDuca, R. Dolin, and C. Ortale 1985 4 p refs Presented at the IEEE Symposium, San Francisco, Calif., 23 Oct. 1985
(Contract DE-AC08-83NV-10282)
(DE86-001103; EGG-10282-2068; CONF-851097-2) Avail: NTIS HC A02/MF A01

A prototype X-ray camera utilizing a 1.5- by 1.5-in., 1024-element, thin mercuric iodide detector array has been tested and evaluated. The microprocessor-based camera is portable and operates at room temperature. Events can be localized within 1 to 2 mm at energies below 60 keV and within 5 to 6 mm at energies on the order of 600 keV. DOE

**N86-22918#** California Univ., Berkeley. Lawrence Berkeley Lab.
**APPLICATION OF A dc SQUID TO RF AMPLIFICATION: NQR**
C. Hilbert, J. Clarke, T. Sleator, and E. L. Hahn May 1985 13 p Presented at the 3rd International Conference on Superconducting Quantum Devices, Berlin, West Germany, 25 Jun. 1985 Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC03-76SF-00098)
(DE86-001986; LBL-19653; CONF-8506203-1) Avail: NTIS HC A02/MF A01

Superconducting QUantum Interference Devices (SQUIDs) have been used for more than a decade for the detection of magnetic resonance. Until recently, these devices had mostly been confined to operation in the audiofrequency range, so that experiments have been restricted to measurements of resonance at low frequencies, or of changes in the static susceptibility of a sample induced by RF irradiation at the resonant frequency. However, the recent extension of the operating range of low noise dc SQUIDs to radiofrequencies (RF) allows one to detect magnetic

resonance directly at frequencies up to several hundred megahertz. The properties of dc SQUIDs as tuned RF amplifers are summarized. The development of a SQUID system for the detection of pulsed nuclear quadrupole resonance (NQR) at about 30 MHz and is described and then, a novel technique for observing magnetic resonances in the absence of any externally applied RF fields is also described. DOE

**N86-22919#** Advanced Environmental Research Group, Cambridge, Mass.
**HOLOGRAPHIC DIFFRACTIVE STRUCTURE FOR DAYLIGHTING, PHASE 1 Final Report, FY85**
10 Oct. 1985 44 p
(Contract DE-AC03-84SF-15292)
(DE86-001268; DOE/SF-15292/T1) Avail: NTIS HC A03/MF A01

Advanced Environmental Research Group (AERG) has researched and developed a proprietary device which will passively track the Sun throughout a wide range of latitudes, hours of the day and seasons of the year. The Holographic Diffractive Structure (HDS), consists of novel holographic diffraction grating designs applied to a substrate suitable for mounting or incorporated into window glazings. The HDS installations will be a low cost system for the controlled management of sunlight in buildings for energy savings and an enhanced lighting environment. The HDSs act to intercept sunlight and redirect it away from the immediate window area towards the darker regions at the rear of the room, or (via light guides) to interior spaces without windows, or (used on the facade of a building) to redirect sunlight into dark urban canyons or onto the facades of other nearby buildings. DOE

**N86-22920#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
**URANIUM DETERMINATION ON-LINE USING REMOTE FIBER FLUORIMETRY**
R. A. Malstrom 1985 32 p ref Presented at the 12th Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Philadelphia, Pa., 29 Sep. 1985
(Contract DE-AC09-76SR-00001)
(DE86-001971; DP-MS-85-76; CONF-8509157-3) Avail: NTIS HC A03/MF A01

Remote Fiber Fluorimetry (RFF) is being developed at Savannah River Laboratory for the on-line determination of uranium in plant process streams. A prototype system suitable for plant use has been designed and is being built. RFF has four major components: a laser, an optical fiber, an optrode, and a detector. Essentially, an optical fiber carries laser radiation from a laser to a process sampling point. An optrode (the optical analog of an electrode) couples the laser light into a sample solution. Fluorescence from the sample is collected by the optrode and goes back through the same fiber to a detector. Using an RFF system, the analysis can be made both simply and safely. The laser and detector are placed at a convenient remote location, such as the control room. Optical fibers run from the laser to either the sample aisle or process tanks. Multiplexing makes it possible to analyze several different sampling positions with one laser and detector. The incentives for demonstrating this technology include reduced analysis time and decreased sample load for the laboratory. Since RFF is a remote on-line technique, sample handling is avoided. Analysis time is five minutes (versus the four-hour minimum needed now), and the control laboratory has a decreased sample load. Finally, RFF could easily be incorporated into a large-scale process control system. DOE

**N86-22921#** Knolls Atomic Power Lab., Schenectady, N. Y.
**CUSTOMIZED AUGER DATA ANALYSIS AND DISPLAY USING THE PHYSICAL ELECTRONICS MODEL 595 AUGER SPECTROMETER**
R. A. Mulford and F. S. Austin 27 Jun. 1985 45 p
(Contract DE-AC12-76SN-00052)
(DE86-002020; KAPL-4189) Avail: NTIS HC A03/MF A01

This report describes how customized data processing with the Physical Electronics MACS computer automation system and optional FORTRAN Linker Package can improve and simplify data display and quantitative analysis of Auger spectra acquired using the Physical Electronics Model 595 Scanning Auger Multiprobe. Techniques described are especially suited to the analysis of a series of spectra with similar data acquisition parameters and eliminate the repetitive steps necessary using the standard format of the manufactures software. Data quantification routines have a greatly improved capability to analyze closely spaced peaks (such as Cr and O), small peaks near the limit of detectability, and peaks that are changing during ion sputtering. All routines use the graphics display terminal and computer included in the MACS system, and no additional computer hardware is required. DOE

**N86-22922#** Oak Ridge National Lab., Tenn.
**TANDEM MASS SPECTROMETER FOR THE DETECTION OF NITROAROMATIC COMPOUNDS AND OTHER ELECTRONEGATIVE SPECIES IN AMBIENT AIR**
G. L. Glish, S. A. McLuckey, and H. S. McKown 1985 6 p Presented at the 28th Conference on Analytical Chemistry, Knoxville, Tenn., 30 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002202; CONF-850937-3) Avail: NTIS HC A02/MF A01

A tandem mass spectrometer has been constructed consisting of a quadrupole mass filter followed by a time-of-flight mass spectrometer. Ions are generated in an atmospheric pressure ionization (API) source, which allows for detection of certain types of compounds in ambient air. The combination of API with this tandem mass spectrometer offers the potential to do real-time monitoring of targeted compounds that are of environmental and other concern. DOE

**N86-22923#** Stanford Linear Accelerator Center, Calif.
**SLAC SCANNER PROCESSOR APPLICATIONS IN THE DATA ACQUISITION SYSTEM FOR THE UPGRADED MARK 2 DETECTOR**
T. Barklow, T. Glanzman, A. J. Lankford, and K. Riles Sep. 1985 4 p refs Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985
(Contract DE-AC03-76SF-00515)
(DE86-002939; SU-SLAC-PUB-3781; CONF-851009-14) Avail: NTIS HC A02/MF A01

The SLAC Scanner Processor is a general purpose, programmable FASTBUS crate/cable master/slave module. This device plays a central role in the readout, buffering and pre-processing of data from the upgraded Mark 2 detector's new central drift chamber. In addition to data readout, the SSPs assist in a variety of other services, such as detector calibration, FASTBUS system management, FASTBUS system initialization and verification, and FASTBUS module testing. DOE

**N86-22924#** Lawrence Livermore National Lab., Calif.
**USE OF GAS IMAGING AS AN EMERGENCY RESPONSE TOOL**
T. G. McRae Oct. 1985 9 p refs Presented at the JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, Calif., 4 Nov. 1985
(Contract W-7405-eng-48)
(DE86-001907; UCRL-92482; CONF-8511110-2) Avail: NTIS HC A02/MF A01

The Backscatter/Absorption Gas Imaging (BAGI) technique is a promising new concept for the location and tracking of hazardous gases. The fundamental principle of the technique is that if hazardous gases were visible to the human eye, it would be easy to locate the source of a leak or, in the case of an accidental spill, to determine the extent and direction of movement of the resulting vapor cloud. The ability to image these gases thus represents a very practical emergency response tool. The BAGI technique offers a simple way to accomplish these goals by integrating an infrared (IR) laser and an IR imaging system. An airborne BAGI system could be used to determine the location of hazardous gas clouds resulting from disabled vessels at sea, train derailments or tanker truck accidents. This real-time capability would provide valuable input for evacuation decisions facing emergency response teams. The BAGI technique shows promise

as a long-range detection system capable of quickly locating the sources of hazardous gas and monitoring the dispersion clouds even at very low concentration levels. The system is simple to operate and interpret, and is composed of field-proven instruments which should make commercialization easy. DOE

**N86-22925#** Oak Ridge National Lab., Tenn.
**SELECTION OF SENSORS FOR MEASUREMENT AND CONTROL**
G. N. Miller and R. L. Anderson 1985 18 p Presented at the Instrument Society of America International Conference and Exhibit, Philadelphia, Pa., 21 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002235; CONF-851045-4) Avail: NTIS HC A02/MF A01

Factors essential to the selection process are presented. Some factors considered are the parameters to be measured, range, environment, allowable uncertainty, desired output, medium in contact with sensor, and the tired and true versus the state of the art. DOE

**N86-22926#** Los Alamos National Lab., N. Mex.
**INVESTIGATIONS OF FLUCTUATIONS IN INSTRUMENTAL RESPONSES BY PRINCIPAL COMPONENTS ANALYSIS**
L. E. Wangen, G. E. Bentley, V. T. Hamilton, and E. J. Peterson 1985 8 p refs Presented at the 28th Oak Ridge National Laboratory Conference on Analytical Chemistry, Knoxville, Tenn., 1 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002385; LA-UR-85-3544; CONF-8510151-12) Avail: NTIS HC A02/MF A01

Principal components analysis was evaluated as a chemometric method for investigating the sources of variation in multicomponent analytical instruments. Many measurements of a 20-element standard were made over several days of operation with a direct-current argon plasma emission spectrometer designed to simultaneously measure the emission intensity at 20 analytical wavelengths. The number of components necessary to account for signal variations and the interelement correlations were determined by a principal components analysis. These results were used to identify the minimum number of independent sources of instrument variation and therefore the minimum number of internal standards needed to correct nonrandom fluctuations in instrument response. Correlations of the analytical signals with the principal components provide guidance for selecting internal standards. DOE

**N86-22927#** Sira Inst. Ltd., Chislehurst (England).
**DEVELOPMENT OF THE PRIMARY GRAVIMETRIC HYGROMETER FOR THE UK NATIONAL HUMIDITY STANDARD FACILITY**
Andrew G. Forton and Robert F. Pragnell 1985 12 p refs Presented at 1985 International Symposium on Moisture and Humidity, Washington, D.C., 15-18 Apr. 1985
Avail: NTIS HC A02/MF A01

A primary gravimetric hygrometer for the measurement range from minus 50 to plus 80 C dewpoint was developed for the UK national standard. Determination of the mass of dry gas, and of water, and the microbalance and balance chamber are described. Author (ESA)

**N86-22599#** Centre Suisse de Documentation dans le Domaine de la Microtechnique, Neuchatel.
**CODUST: A NEW CONCEPT FOR A QUARTZ CRYSTAL MICROBALANCE**
J. Sekler, H. E. Hintermann, and A. Zwaal (ESA/ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 55-58 refs (For primary document see N86-22593 13-18)
(Contract ESTEC-4907/81)
Avail: NTIS HC A13/MF A01

**N86-22611#** Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Etablissement d'Aquitaine.
**HOLOGRAPHY: THE NONDESTRUCTIVE TESTING OF COMPOSITE STRUCTURES**
P. Barbier and C. LeFloch *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 161-165 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22619#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**HIGH VOLTAGE POTTING FOR THE FAINT OBJECT CAMERA (FOC)**
R. Thomas *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 223-228 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22625#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**PARTICLE FALLOUT PHOTOMETER (PFO)**
M. VanEesbeek, R. Berkeljon, and H. Kuiper (URAMEC, Bilthoven, Netherlands) *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 271-274 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22626#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**ULTRAVIOLET RADIOMETERS**
G. Gourmelon, H. Lyall (IRD, Newcastle upon Tyne, England), and R. Froud (IRD, Newcastle upon Tyne, England) *In its* Proceedings of 3rd European Symposium on Spacecraft Materials Space Environment Nov. 1985 p 275-276 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22755#** Joint Publications Research Service, Arlington, Va.
**HOLOGRAPHIC NDT OF THIN TITANIUM PLATE DESCRIBED**
Ruixiang Yang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 112-117 refs Transl. into ENGLISH from Xiyou Jinshu (Beijing, China), v. 9, no. 4, Jul. 1985 p 58-61 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-23262#** Joint Publications Research Service, Arlington, Va.
**APPARATUS ASSEMBLY FOR PSYCHOPHYSICAL STUDIES ON VISUAL PERCEPTION Abstract Only**
A. I. Nazarov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 121 Transl. into ENGLISH from Voprosy Psilhologii (Moscow, USSR), no. 3, May-Jun. 1985 p 159-162 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

## 36 LASERS AND MASERS

Includes parametric amplifiers.

**N86-22928** California Inst. of Tech., Pasadena.
**DYNAMIC AND SPECTRAL FEATURES OF SEMICONDUCTOR LASERS Ph.D. Thesis**
Kerry John Vahala 1985 175 p
Avail: Univ. Microfilms Order No. DA8522634

The discussion of fluctuations in lasers is a topic as old as the device itself. Surprisingly, however, several new chapters in this field are being written, because of certain pecularities only recently observed in semiconductor lasers. Chapters 2 and 3 of this thesis will consider these pecularities, which, as it turns out, are quite important in many potential system applications of these devices. One of the driving forces behind the development of semiconductor lasers has been their application as sources and local oscillators in optical communication systems. In general such

applications require lasers which have low phase and intensity noise, and which can be modulated at high data rates. As is often the case, these requirements are to a certain extent mutually exclusive. Chapter 4 introduces a technique which is an exception to this rule. It relies upon the semiconductor laser physics which produces the fluctuation abnormalities discussed in Chapter 2 and 3. The technique can be used to improve modulation speed while simultaneously reducing noise as compared to the conventional device. Dissert. Abstr.

**N86-22929** New Mexico Univ., Albuquerque.
**NUMERICAL PROCESSING OF WAVEFRONT ABERRATION MEASUREMENTS Ph.D. Thesis**
Christopher Roy DeHainaut 1985 106 p
Avail: Univ. Microfilms Order No. DA8518560

It is found that noise effects are dominated by electron shot noise, which is essentially a classical phenomenon. The laser startup with noise is seen to be more realistic than with artificial seed pulses. In addition, the laser startup near the point of synchronous cavity length is much faster than with no noise and the laser operates weakly for cavity lengths longer than the synchronous length. The extension of the simulation of two dimensions causes no large changes in the behavior as long as the higher order radial modes are strongly attenuated. When the losses for the higher order modes are reduced, the range of cavity lengths over which the laser operates is reduced and the peak gain is increased. In addition, the small signal frequency is downshifted from the value for a single mode. A heuristic explanation for this phenomenon is advanced. The results of the simulation are compared with experimental results obtained from the Stanford laser. The cavity length detuning curve is shorter and the gain is lower than expected. No evidence is seen for the sideband instability which is anticipated from the simulations.
Dissert. Abstr.

**N86-22930** California Univ., Los Angeles.
**NEODYMIUM: SODIUM BETA DOUBLE PRIME ALUMINA AS A LASER MEDIUM Ph.D. Thesis**
Anthony James Alfrey 1985 178 p
Avail: Univ. Microfilms Order No. DA8525832

Sodium Beta Alumina is a solid ionic conductor in which trivalent rare-earths may be exchanged for sodium after a raw crystal is grown, in contrast to traditional laser hosts where the rare earth dopant is added to the basic crystal melt from the start. Samples of Sodium Beta Double Prime Alumina were exchanged with various concentrations of trivalent neodymium, absorption spectra have been taken for these samples, and a Judd/Ofelt analysis performed. Anomalously large values of oscillator strengths were observed for lines which depend strongly on a linear term in the crystal field. A point charge model with a simple modification for ligand dipole polarizability has been used to calculate Judd/Ofelt parameters for several possible deviations from near neighbor inversion symmetry. Parameters calculated for the types of distortions known to exist based on X-ray diffraction data agree moderately well with parameters calculated from spectra. The Judd/Ofelt parameters are used to calculated radiative lifetimes and stimulated emission cross sections, which are important data for potential laser candidates. Dissert. Abstr.

**N86-22931** California Univ., Los Angeles.
**UNSTABLE RESONATOR SEMICONDUCTOR LASERS Ph.D. Thesis**
Richard Randall Craig 1985 150 p
Avail: Univ. Microfilms Order No. DA8525843

Wet chemical etching was used for the first time to produce unstable resonator Gallium Arsenide lasers. These devices use the mode selective property of the resonator to force a broad area (> 100 um wide) laser to operate in a single lateral and longitudinal mode. Single facet optical powers as high as 400 mW were obtained. The general theory of unstable resonators for laser cavities is presented along with design considerations specific to the GaAs/AlGaAs laser system. Details of the processing steps used to fabricate curved etched mirrors on the semiconductor wafer are given. Results of optical testing indicate that the laser oscillates in a single stable lateral mode as long as the cavity magnification is greater than 3.5. When operating in a single spatial mode the lasers often also emit in a single spectral mode. Tapered devices designed to optimize the differential efficiency at a single facet showed efficiencies as high as .15 W/A. Models for both the threshold current and the differential efficiency agreed well with experimental observations. Finally new unstable resonator geometries which should further improve the optical properties of this new class of semiconductor lasers are described.
Dissert. Abstr.

**N86-22932** Royal Signals and Radar Establishment, Malvern (England).
**TRANSIENT ANNEALING OF SEMICONDUCTORS BY LASER ELECTRON-BEAM AND RADIANT HEATING TECHNIQUES**
A. G. Cullis 1985 172 p refs Repr. from Repts. on Prog. in Phys., v. 48, no. 8, p 1155-1233
(RSRE-MEMO-3814) HC A08/MF A01

Annealing techniques which rely upon transient energy deposition in semiconductors from Q-switched and scanning continuous wave laser, electron beam, ion beam, and other radiant sources are reviewed. Advances achieved using transient annealing methods in fundamental and applied physics are described.
Author (ESA)

**N86-22933#** Department of the Air Force, Washington, D.C.
**DISCRETE PHASE CONJUGATE TECHNIQUE FOR PRECOMPENSATION OF LASER BEAMS TRANSMITTED THROUGH TURBULENCE Patent Application**
Mac Govern, inventor (to Air Force) Filed 11 Jun. 1985 21 p
(AD-D012013; US-Patent-Appl-SN-743550) Avail: NTIS HC A02/MF A01 CSCL 20/5

A process and apparatus are disclosed for aligning a laser beam from a laser transmitter with an incoming laser beam, and driving any sensed tilt differences on an aperture and subaperture basis to zero. The apparatus uses a shared aperture component to sample the outgoing laser beam and the incoming target beam, a retroreflector array to reverse the direction of the subaperture samples of the outgoing beam, a common-mode wavefront sensor to measure subaperture tilt differences between the reversed samples of the laser and the incoming target beam, and a deformable mirror to drive any sensed tilt differences to zero. A transparent beamsplitter is used as the shared aperture component and an AC shearing interferometer is used as the basis for the common-mode sensing. By forcing the outgoing beam to be then conjugate of the incoming beam it is automatically precompensated for any aberrations in the transmission patch. GRA

**N86-22934#** California Univ., Berkeley. Lawrence Berkeley Lab.
**DESIGN CONCEPTS OF A STORAGE RING FOR A HIGH POWER XUV FREE ELECTRON LASER**
M. Cornacchia, J. Bisognano, S. Chattopadhyay, A. Garren, K. Halbach, A. Jackson, K. J. Kim, H. Lancaster, J. Peterson, and M. S. Zisman Aug. 1985 25 p Presented at the 7th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985 Prepared in cooperation with Brookhaven National Lab., Upton, N.Y.
(Contracts DE-AC02-76CH00016; DE-AC03-76SF-00098)
(DE86-001482; LBL-20216; CONF-850956-3) Avail: NTIS HC A02/MF A01

The study of a storage ring capable of sustaining an electron beam of the quality required for a High Gain Free Electron Laser in the vacuum ultraviolet and X-ray region is reported. A method is described for the optimization of the design of the storage ring, where several competing and often conflicting requirements come into play. An example design is presented of a ring that satisfies the required conditions of beam quality and is able to produce coherent radiation at 400 A with tens of megawatts of peak power. DOE

**N86-22935#** Pacific Northwest Lab., Richland, Wash.
**TIME-RESOLVED TEMPERATURE DETERMINATIONS FROM**

**RAMAN SCATTERING OF TiO2 COATINGS DURING PULSED LASER IRRADIATION**

G. J. Exarhos Aug. 1985 17 p Presented at the Boulder Damage Symposium, Boulder, Colo., 15 Oct. 1985
(Contract DE-AC06-76RL-01830)
(DE86-002057; PNL-SA-13432; CONF-8510101-3) Avail: NTIS HC A02/MF A01

Simultaneous measurement of Stokes/anti-Stokes Raman intensities for a particular vibrational mode allows instantaneous surface temperatures to be determined. Time-resolved Raman spectra were measured on a specially constructed spectrometer using pulsed laser excitation and gated detection techniques. Measurements on equilibrated coatings and uncoated substrates at several temperatures served to confirm the utility of the technique for temperature determination as well as calibrate the intensity response of the instrument. Pulsed irradiated SiO2 and Y(PO3)3 glass substrates yield no temperature increase at laser energies where surface damage is not apparent. At higher pulse energies, an increase in anti-Stokes scattered radiation is observed, signifying a temperature rise. Analogous results are seen in Raman spectra of low energy pulse-irradiated TiO2 coatings recorded at delays of 0 and 72 ns from the excitation pulse. At higher energies, increased coating temperatures are observed at these times as well as at short times preceding the peak maximum of the excitation pulse. Raman results are used to model the thermal response of pulsed laser-irradiated dielectric coatings. DOE

**N86-22936#** Pacific Northwest Lab., Richland, Wash.
**RAMAN MICROPROBE OF LASER-INDUCED SURFACE DAMAGE REGIONS IN TiO2 COATINGS**

D. M. Friedrich and G. J. Exarhos Aug. 1985 17 p Presented at the Boulder Damage Symposium, Boulder, Colo., 15 Oct. 1985
(Contract DE-AC06-76RL-01830)
(DE86-002059; PNL-SA-13433; CONF-8510101-2) Avail: NTIS HC A02/MF A01

The anatase-to-rutile phase transition, which attends pulsed laser-induced damage of anatase TiO2 thin films, is studied by simultaneous microphotography and Raman microprobe. The damage is distributed across the damage area in regions of distinct morphology and spectra. In multilayer coatings, a mechanical surface-fracture zone surrounds a set of thin, layered flat rings of distinct but irregular boundaries. These rings surround a rough, pitted transparent central crater in the quartz substrate. Raman difference spectroscopy is used to reveal damage regions containing the rutile phase and regions devoid of TiO2. DOE

**N86-22937#** Spectra Technology, Inc., Bellevue, Wash.
**LASER TECHNOLOGIES FOR LASER ACCELERATORS Annual Report**

May 1985 209 p
(Contract DE-AC06-83ER-40128)
(DE85-013588; DOE/ER-40128/T1) Avail: NTIS HC A10/MF A01

The primary result of the work reported is the determination of laser system architectures that satsify the requirements of high luminosity, high energy (about 1 TeV), electron accelerators. It has been found that high laser efficiency is a very hard driver for these accelerators as the total average laser output optical power is likely to fall above 10 MW. The luminosity requires rep rates in the kHz range, and individual pulse lengths in the 1 to 10 psec range are required to satisfy acceleration gradient goals. CO2 and KrF lasers were chosen for study because of their potential to simultaneously satisfy the given requirements. Accelerator luminosity is reviewed, and requirements on laser system average power and rep rate are determined as a function of electron beam bunch parameters. Laser technologies are reviewed, including CO2, excimers, solid state, and free electron lasers. The proposed accelerator mechanisms are summarized briefly. Work on optical transport geometries for near and far field accelerators are presented. Possible exploitation of the CO2 and DrF laser technology to generate the required pulse lengths, rep rates, and projected efficiencies is illustrated and needed development work is suggested. Initial efforts at developing a 50 GeV benchmark conceptual design and a 100 MeV demonstration experiment conceptual design are presented. DOE

**N86-22938#** Sandia National Labs., Albuquerque, N. Mex.
**LASER-CONTROLLED WET CHEMICAL ETCHING FOR CORRECTIVE TRIMMING OF THIN FILMS: APPLICATION TO ALUMINUM**

J. Y. Tsao and D. J. Ehrlich 1985 12 p Presented at the 168th Meeting of the Electrochemical Society, Las Vegas, Nev., 13 Oct. 1985 Prepared in cooperation with Massachusetts Inst. of Tech., Lexington, Mass.
(Contract DE-AC04-76DP-00789)
(DE86-002168; SAND-85-2239C; CONF-851048-7) Avail: NTIS HC A02/MF A01

The localized enhancement of wet chemical etching by focussed laser beams for corrective trimming of thin films, and its application to the selective etching of aluminum, are discussed. Since wet etching can proceed repidly even without irradiation, it is as important to consider methods to reduce background etching as to enhance localized etching. The process developed for aluminum etching is based upon moderate local heating to activate a reaction which is normally suppressed by a corrosion inhibitor. Another approach to reduce background etching is solution cooling: for the activation energies for typical wet-etching, it should be possible to obtain acceptable contrast ratios between laser-enhanced and background rates over the temperature range which many concentrated etching solutions are liquid. DOE

**N86-22939#** Lawrence Livermore National Lab., Calif.
**LOW-COST LASER DIAGNOSTIC SYSTEM**

T. J. Ramos, D. R. Lim, and A. C. Lingenfelter Oct. 1985 20 p Presented at the ICALEO International Congress on the Applications of Lasers and Electro-Optics, San Francisco, Calif., 11 Nov. 1985
(Contract W-7405-eng-48)
(DE86-002370; UCRL-93463; CONF-8511103-2) Avail: NTIS HC A02/MF A01

The principal feature of a new laser diagnostic system is real-time display of beam energy profile. This ensures on-line verification of beam mode and stability with capability for computer storage of this information for later analysis. This system provides low-cost control and repeatability, essential in precision metalworking operations. DOE

**N86-22940#** Los Alamos National Lab., N. Mex.
**QUANTIZED FIELD FORMULATION OF THE FREE-ELECTRON LASER IN THE HEISENBERG PICTURE**

H. Takeda 1985 15 p ref Presented at the 7th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract W-7405-eng-36)
(DE86-002392; LA-UR-85-3212; CONF-850956-5) Avail: NTIS HC A02/MF A01

The phase and amplitude operator equations valid for field intensities ranging from a single photon state to an intense laser state are derived by means of quantized field theory. Using the Dirac equation, driving current operators, which are expressed by radiation and electron fields, are separated into spontaneous, stimulated, and spin terms. Then, utilizing the semiclassical nature of the electron state, coherence condition and spectral equations are derived. From the spectral phase equation, a delay-time scaling for oscillator operation is obtained in good agreement with experiments. DOE

**N86-22941#** Los Alamos National Lab., N. Mex.
**LOS ALAMOS KrF LASER PROGRAM**

R. J. Jensen and D. C. Cartwright 1985 11 p Presented at the 7th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, Calif., 28 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002427; LA-UR-85-3851; CONF-851053-2) Avail: NTIS HC A02/MF A01

Los Alamos is currently developing the krypton fluoride (KrF) laser - a highly efficient laser able to emit very intense bursts of

short-wavelength photons - as a research tool for the general study of high-density matter, as well as for use in laser fusion. The KrF laser operates at 1/4 (micro)m, close to the short-wavelength limit for conventional optical material, but still in the region where standard optical techniques can be used. The excited-state lifetime of the KrF lasing medium is short - as a result of both spontaneous emission and deactivation from collisions - making it impossible to store energy within the lasing medium for times significant to electrical pumping. However, an optical multiplexing scheme is being developed that will generate short, intense pulses of 1/4-(micro)m light by overcoming the short storage time of the laser and taking advantage of the high gain of the KrF medium. DOE

**N86-22942#** Los Alamos National Lab., N. Mex.
**NEW HIGH-BRIGHTNESS ELECTRON INJECTOR FOR FREE-ELECTRON LASERS DRIVEN BY RF LINACS**
J. S. Fraser, R. L. Sheffield, and E. R. Gray 1985 22 p Presented at the 6th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000781; LA-UR-85-3176; CONF-850956-1) Avail: NTIS HC A02/MF A01

A free-electron laser oscillator, driven by an RF linac, requires a train of electron bunches delivered to an undulator. The brightness requirement exceeds that available from a conventional linac with RF bunchers. The demonstrated high brightness of laser-illuminated photoemitters indicates that the conventional buncher system might be eliminated entirely, thereby avoiding the usual loarge loss in brightness that occurs in bunchers. A photoemitter with a current density of about 200 A/sq cm is placed on an end wall of an RF cavity to accelerate a 60-ps bunch of electrons to 1 MeV as rapidly as possible. Preliminary experimental work, simulation calculations, and discussions on emittance measurement techniques and positive ion motion in the RF gun are presented. DOE

**N86-22624#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**SCANNING LASER ACOUSTIC MICROSCOPY APPLIED TO THE EVALUATION OF MATERIAL INTERCONNECTIONS**
B. D. Dunn and D. S. Collins *In its* Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 263-269 (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

**N86-22743#** Joint Publications Research Service, Arlington, Va.
**LIFETIME OF EXCIMER LASER STUDIED**
Xuejin Hu, Zhensheng Zhao, Zhaolin Li, and Mingyu Che *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 8-13 refs Transl. into ENGLISH from Guangxue Xuebao [Acta Optica Sinica] (Shanghai, China), v. 5, no. 10, Oct. 1985 p 881-885 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

**N86-22744#** Joint Publications Research Service, Arlington, Va.
**THE 1.36J OUTPUT OBTAINED FROM XeCl EXCIMER LASER**
Xusan Cheng, Qihong Lou, and Runwen Wang *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 14-20 refs Transl. into ENGLISH from Guangxue Xuebao [Acta Optica Sinica] (Shanghai, China), v. 5, no. 10, Oct. 1985 p 865-869 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

**N86-22776#** Joint Publications Research Service, Arlington, Va.
**INVESTIGATION OF COLLIDING-MODE Nd:YAG LASER**
Xing Lin, Wenzhen Zhang, Huiming Zhuang, and Fengtie Wu *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 142-148 refs Transl. into ENGLISH from Guangxue Xuebao (Shanghai, China), v. 5, no. 9, Sep. 1985 p 794-798 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

**N86-22787*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PRELIMINARY RESULTS TOWARD INJECTION LOCKING OF AN INCOHERENT LASER ARRAY**
James Daher *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 26-34 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 20E

# 37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

**N86-22943** California Univ., Berkeley.
**NONLINEAR SYSTEM CONTROLLER DESIGN BASED ON DOMAIN OF ATTRACTION Ph.D. Thesis**
Philip S. Babcock, IV 1985 126 p
Avail: Univ. Microfilms Order No. DA8524884

A technique for analyzing and designing controllers for nonlinear systems based on measures of the domain of attraction is presented. The domain of attraction is the region of initial conditions that tend toward an attractor and it is delineated by randomly selecting initial conditions from the region of state space being investigated. Error determinations are found by repeating the domain simulations with independent samples. A reinfement of this region is the domain of performance which is the region of initial conditions that meet a performance criteria. In nonlinear systems, local stability does not insure stability over a larger region. The domain of attraction marks out this stability region; hence, it can be considered a measure of a nonlinear system's ability to recover from state perturbations. When considering random perturbations, the minimum radius of the domain is a measure of the magnitude of perturbations for which recovery is guaranteed. An advantage of this measure is that it is a vector length and, therefore, is applicable to systems with any dimension. The use of the domains of attraction and performance are demonstrated in controller design of an inverted pendulum. Dissert. Abstr.

**N86-22944** Cornell Univ., Ithaca, N.Y.
**NONLINEAR DYNAMICS OF IMPERFECT FLUID JOURNAL BEARINGS Ph.D. Thesis**
Dazong Wang 1985 160 p
Avail: Univ. Microfilms Order No. DA8525680

A theoretical model for the study of effects of fluid journal bearing surface geometrical imperfection is developed. The imperfection on the journal and on the sleeve is considered separately. In each case, the analytical description of the imperfection includes a small sinusoidal term and the model is described by a set of nonlinear ordinary differential equations. Analytical approach is adopted in this investigation to a great extent. The conditions involved in Reynolds equation are examined in the context of surface imperfections. Ocvirk short bearing approximation is used and the cavitation problem is dealt with Half-Sommerfeld boundary condition. The symbolic computer software package MACSYMA proved invaluable in performing mathematical manipulations. For a sleeve imperfect system, the dynamic equations are autonomous. It is seen that the pressure distribution becomes more complicated. A perturbation technique is used to obtain the fluid force, based on which static equilibrium calculation and stability analysis are performed analytically. Dissert. Abstr.

**N86-22945** Illinois Univ., Chicago.
**HELICAL AND SPUR GEARS WITH NEW TYPES OF TOOTH SURFACES Ph.D. Thesis**
Chung-Biau Patrick Tsay 1985 227 p
Avail: Univ. Microfilms Order No. DA8524820

Helical and spur gears were studied to improved performance. The research included helical gears with circular arc teeth, helical gears with pinion circular arc teeth and gear involute teeth, spur gears with pinion teeth of crowned surfaces, and gear involute

teeth. The following topics covered are: methods for generation of the above mentioned gears, derivation of the equations of the gear tooth surfaces; principal curvatures and directions of the gear tooth surfaces, dimensions and orientation of the contact ellipse; computer aided simulation of the conditions of meshing and bearing contact; influence of conditions of meshing and bearing contact; influence of manufacturing and assembly errors on the kinematical errors of the gears in mesh; and proposed methods for the adjustment of gears to compensate for the errors of assembly. The applications of the proposed methods are illustrated by computer aided numerical examples and computer graphics.
Dissert. Abstr.

**N86-22946** Department of the Air Force, Washington, D.C.
**ADJUSTABLE BALANCE WEIGHT FOR ROTATING SHAFT Patent**
David J. Wiebe, inventor (to Air Force) Issued 10 Sep. 1985 4 p Supersedes AD-D009704
(AD-D011988; US-Patent-4,539,864; US-Patent-Appl-SN-393267; US-Patent-Class-74-573) Avail: US Patent and Trademark Office CSCL 13/9

A balance weight mechanism which is attached to a tubular engine shaft for correcting unbalance in the engine is disclosed. The tubular shaft includes a stiffener plate mounted therein transversely to the rotational axis of the shaft. The balance weight mechanism includes a balance weight arm and a fastener for releasably fastening an end of the arm to a generally central location on the stiffener plate where the axis of rotation of the shaft intersects the plate. Spline teeth on the balance weight arm face toward the stiffener plate and are aligned to intermesh with an arc of an annular spline ring on the plate for holding the arm in a desired angularly adjusted position extending outwardly radially from the axis of rotation of the shaft when the arm is fastened tightly against the plate. GRA

**N86-22947** Department of the Air Force, Washington, D.C.
**FUEL PUMP VENT DRAIN SYSTEM Patent**
Richard L. Stanley and George R. Henry, inventors (to Air Force) Issued 10 Sep. 1985 4 p Supersedes AD-D010870
(AD-D011993; US-Patent-4,539,809; US-Patent-Appl-SN-566445; US-Patent-Class-60-39.094) Avail: US Patent and Trademark Office CSCL 21/5

A novel drain system for venting excess fuel from the fuel pump of a jet engine, and particularly the augmenter pump of a jet engine afterburner is described. It comprises a drain line connected at a first end to the vent valve of the fuel pump and at a second end to the main fuel supply line for the engine, for draining the excess fuel from the pump to the main fuel line; a check valve in the drain line near the second end thereof for restricting fuel flow through the drain line in a direction from the first end to the second end; and a vent line having a restriction therein defining an orifice of predetermined size connecting the drain line to an overboard dump port open to ambient. GRA

**N86-22948** Department of the Air Force, Washington, D.C.
**LOADING DOLLY Patent**
Lawrence E. Fielding, inventor (to Air Force) Issued 3 Sep. 1985 8 p Supersedes AD-D010492
(AD-D012010; US-Patent-4,538,792; US-Patent-Appl-SN-512062) Avail: US Patent and Trademark Office CSCL 13/3

A loading dolly has a loading frame adapted to be raised or lowered through horizontal movement of screw jacks which pivot mobile carriages, articulately coupled to the jacks and frame, in a generally vertical direction about the loading frame. Author (GRA)

**N86-22949** Westland Helicopters Ltd., Yeovil (England). Dept. 142.
**A PRELIMINARY STUDY OF BEARING RACE INTERFACE SLIP Final Report**
S. G. Gillingham 1 Feb. 1985 58 p refs
(Contract A26B/80)
(MRR-20082; BR94941) Avail: Issuing Activity

Bearing race interface slip was studied to evolve an analytical design tool to predict the onset of slip for a variety of bearing configurations. It is possible to predict the onset of slip for a single rolling contact load knowing the stress distribution and coefficient of friction at the interface provided that the load distribution is uniform in the axial direction. This analytical method was extended for bearing applications by considering the effect of multiple contact loads. Experiments to validate this analysis were performed but because of significant variations of loading in the axial direction the results could not be used. Nevertheless, the treatment of multiple contact loads is believed to be correct. For nonuniform cases an empirical solution of the slip problem is proposed. Author (ESA)

**N86-22950#** Department of the Air Force, Washington, D.C.
**TRANSLATIONAL MOUNT FOR LARGE OPTICAL ELEMENTS Patent Application**
John D. German, inventor (to Air Force) Filed 12 Jun. 1985 24 p
(AD-D012004; US-Patent-Appl-SN-743845) Avail: NTIS HC A02/MF A01 CSCL 20/6

This patent application discloses a translational mount for supporting large optical elements, the mount having a stationary support, a mounting ring pivotally attached to the support, a first eccentric ring rotatably mounted within the mounting ring, a second eccentric ring rotatably mounted within the first ring, and an element rotatably mounted within the second ring securing the large optical element thereto. By the appropriate rotational movement of the pair of eccentric rings the optical element is displaced a predetermined amount in both the horizontal and vertical directions. GRA

**N86-22951#** Department of the Air Force, Washington, D.C.
**MISSILE LONGITUDINAL SUPPORT ASSEMBLY Patent Application**
Gassler, inventor (to Air Force) Filed 6 Aug. 1985 16 p
(AD-D012009; US-Patent-Appl-SN-762888) Avail: NTIS HC A02/MF A01 CSCL 15/5

A shock resistant missile longitudinal support assembly is described. It provides axial support to a canisterized missile while allowing the missile to translate under shock in any radial direction relative to the longitudinal axis of the canister. Author (GRA)

**N86-22952#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
**EVALUATION OF HEAT SHRINKABLE END CAPS FOR SEALING CUT ENDS OF PIPE**
M. J. Rohe and W. N. Rankin 13 Aug. 1985 13 p ref
(Contract DE-AC09-76SR-00001)
(DE86-001969; DPST-85-670) Avail: NTIS HC A02/MF A01

Decontamination technology to: (1) reduce personnel exposure to penetrating radiation, (2) reduce the potential for uptake of radioactive material, and (3) increase safety is being investigated. The West Valley Demonstration Project has had good experience with using heat-shrinkable end caps for sealing the cut ends of pipe containing radioactive contamination during D and R operations. This procedure is attractive for use at SRL/SRP during D and R operations for both contamination control and for personnel protection against sharp edges. This procedure is quicker than taping cut pipe ends or dipping them in liquid plastic that hardens to form a seal. DOE

**N86-22953#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
**ROBOTIC SYSTEM FOR PROCESS SAMPLING**
G. M. Dyches 1985 7 p Presented at the 33rd Conference on Remote Systems Technology, San Francisco, Calif., 11 Nov. 1985
(Contract DE-AC09-76SR-00001)
(DE86-001967; DP-MS-85-46; CONF-8511117-1) Avail: NTIS HC A02/MF A01

A three-axis cartesian geometry robot for process sampling was developed at the Savannah River Laboratory (SRL) and implemented in one of the site radioisotope separations facilities. Use of the robot reduces personnel radiation exposure and

contamination potential by routinely handling sample containers under operator control in a low-level radiation area. This robot represents the initial phase of a longer term development program to use robotics for further sample automation. Preliminary design of a second generation robot with additional capabilities is also described. DOE

**N86-22954#** Oak Ridge National Lab., Tenn.
**ROBOT NAVIGATION ALGORITHMS USING LEARNED SPATIAL GRAPHS**
S. S. Iyengar, C. C. Jorgensen, S. V. N. Rao, and C. R. Weisbin 1985 37 p Presented at the 2nd Conference on Artificial Intelligence Applications, Miami Beach, Fla., 11 Dec. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002238; CONF-851245-2) Avail: NTIS HC A03/MF A01

Finding optimal paths for robot navigation in known terrain has been studied for some time but, in many important situations, a robot would be required to navigate in completely new or partially explored terrain. We propose a method of robot navigation which requires no pre-learned model, makes maximal use of available information, records and synthesizes information from multiple journeys, and contains concepts of learning that allow for continuous transition from local to global path optimality. The model of the terrain consists of a spatial graph and a Voronoi diagram. Using acquired sensor data, polygonal boundaries containing perceived obstacles shrink to approximate the actual obstacles' surfaces, free space for transit is correspondingly enlarged, and additional nodes and edges are recorded based on path intersections and stop points. Navigation planning is gradually accelerated with experience since improved global map information minimizes the need for further sensor data acquisition. Our method currently assumes obstacle locations are unchanging, navigation can be successfully conducted using two-dimensional projections, and sensor information is precise. DOE

**N86-22955#** Sandia National Labs., Albuquerque, N. Mex.
**ALLOCATION OF TASKS TO ROBOTS FOR IMPROVED SAFETY**
D. S. Kessel Oct. 1985 8 p refs Presented at the National Safety Council Congress, New Orleans, La., 30 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002366; SAND-85-2386C; CONF-8510193-1) Avail: NTIS HC A02/MF A01

The paper points out the potential contributions of industrial robots to the improvement of safety in the workplace. Ergonomic evaluation techniques were identified which may be used to identify overly stressful tasks which may result in overexertion injuries. DOE

**N86-22956#** National Engineering Lab., East Kilbride (Scotland). Thermal Systems Div.
**PERFORMANCE OF DYNAMICALLY LOADED JOURNAL BEARINGS. PART 2: MEASUREMENT OF OIL FILM PRESSURES**
W. L. Cooke Nov. 1983 43 p refs Sponsored by UK Department of Industry's Mechanical Engineering and Machine Tools Requirements Board
(NEL-688-Pt-2; ISSN-0305-1439) Avail: NTIS HC A03/MF A01

Experimentally measured values of oil film pressure in a dynamically loaded bearing are compared with values predicted by narrow bearing theory. The measurements suggest that peak oil film pressures in structurally rigid bearings are likely to be of the order of 65% of those calculated using narrow bearing theory with constant viscosity at average bearing temperature. Peak pressures in engine bearings can be further reduced by bearing flexure. Author (ESA)

**N86-22957#** Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
**RESONANCE COMPENSATING OF WIND POWER PLANTS WITH VARIABLE ROTOR SPEED**
Tommy Svensson Nov. 1985 125 p refs In SWEDISH, ENGLISH summary
(FOA-C-20589-E3; ISSN-0347-3694) Avail: NTIS HC A06/MF A01

Methods to compensate resonance in the drive train of variable rotor speed windpowered generators are compared. Investigations show that the best results are obtained when the shaft torque is measured and used for the compensating. Items analyzed include: soft shafts (machine elements); resonance; turbine blades; the generator; turbine blade angle regulation; the regulation system; simulation language; simulation with or without compensation and with or without integration; and compensated or noncompensated systems. Author (ESA)

**N86-22958#** AiResearch Mfg. Co., Torrance, Calif.
**OPEN-CYCLE CENTRIFUGAL VAPOR-COMPRESSION HEAT PUMP Annual Report, Mar. 1984 - Feb. 1985**
T. L. Iles, L. R. Burgmeier, and A. Y. Liu Apr. 1985 69 p
(Contract GRI-5082-233-0745)
(PB86-103884; GRI-85/0118) Avail: NTIS HC A04/MF A01 CSCL 13A

The objectives of the program are to develop an open-cycle high-lift centrifugal steam compressor system that can be efficiently retrofitted to existing multieffect and high-temperature differential evaporators while maintaining the cost benefits of a single-stage centrifugal compressor and demonstrate the energy saving and cost benefits of driving the compressor with a natural-gas-fueled gas turbine engine. The turbine exhaust will be used for final drying of the product that was evaporated. The design and fabrication of the system and the test activities through February 1985 are described. GRA

# 38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

**N86-22959** Drexel Univ., Philadelphia, Pa.
**CLUTTER SUPPRESSION AND TEXTURE ESTIMATION IN NON-DESTRUCTIVE EVALUATION Ph.D. Thesis**
Israel Amir 1986 165 p
Avail: Univ. Microfilms Order No. DA8524029

Two topics dealing with the reflection of ultrasound bursts from random media are discussed. A general formulation of the echo received from a random scatterer ensemble illuminated by a short electromagnetic or sonic signal was developed. A gradient in either scatterer concentration or in the field function of the transmitter/receiver will return an echo which is partially spatially coherent. Furthermore from the degree of coherency, the scatterer concentration and scattering cross section can be calculated. Experimentally the scattering concentration gradient creates a coherent reflection from whose degree of coherency the scattering concentrations can be estimated. Signal processing techniques for the reduction of clutter noise created by random media composed of a high concentration of point scatterers are explained. A method is described for clutter reduction that also uses the split spectrum principle. In this technique the optimum receiver is constructed for each range delay from the n outputs of the frequency windows. Dissert. Abstr.

**N86-22960#** Royal Armament Research and Development Establishment, Fort Halstead (England). Trials and Evaluation 1 Div.
**A GUIDE TO RELIABILITY ACTIVITIES DURING DEVELOPMENT**
Mar. 1985 69 p refs 2 Vol.
(RARDE-85004; BR96321; RTP-1099/02; FVJ/514/1) HC A04/MF A01

Reliability mathematics and modeling; reliability apportionment; design evaluation; growth analysis and monitoring; and acceptance testing are introduced. Author (ESA)

**N86-22961#** Royal Armament Research and Development Establishment, Fort Halstead (England). Trials and Evaluation 1 Div.

**RELIABILITY MATHEMATICS AND METHODS**

Mar. 1985 229 p refs 2 Vol.

(RARDE-85004-Suppl.; BR96322; RTP-1099/02; FVJ/514/1) HC A11/MF A01

The mathematics and statistical distributions necessary for reliability calculations and data analysis are introduced. It is shown how reliability, availability, and maintainability calculations for complex systems can be facilitated by the use of models based on Boolean algebra. An example of apportioned reliability requirements for a hypothetical system is given. Design evaluation techniques are discussed. Reliability growth models, and the mathematics used in acceptance testing are outlined.

Author (ESA)

**N86-22962*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ANALYTICAL ULTRASONICS IN MATERIALS RESEARCH AND TESTING**

A. Vary Jan. 1986 357 p refs Conference held in Cleveland, Ohio, 13-14 Nov. 1984

(NASA-CP-2383; E-2486; NAS 1.55:2383) Avail: NTIS HC A16/MF A01 CSCL 20A

Research results in analytical ultrasonics for characterizing structural materials from metals and ceramics to composites are presented. General topics covered by the conference included: status and advances in analytical ultrasonics for characterizing material microstructures and mechanical properties; status and prospects for ultrasonic measurements of microdamage, degradation, and underlying morphological factors; status and problems in precision measurements of frequency-dependent velocity and attenuation for materials analysis; procedures and requirements for automated, digital signal acquisition, processing, analysis, and interpretation; incentives for analytical ultrasonics in materials research and materials processing, testing, and inspection; and examples of progress in ultrasonics for interrelating microstructure, mechanical properites, and dynamic response. For individual titles, see N86-22963 through N86-22983.

**N86-22963*#** Johns Hopkins Univ., Baltimore, Md.

**ULTRASONIC NONDESTRUCTIVE MATERIALS CHARACTERIZATION** **c71**

Robert E. Green, Jr. *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 1-29 refs (For primary document see N86-22962 13-38)

Avail: NTIS HC A16/MF A01 CSCL 20A

A brief review of ultrasonic wave propagation in solid materials is presented with consideration of the altered behavior in anisotropic and nonlinear elastic materials in comparison with isotropic and linear elastic materials. Some experimental results are described in which ultrasonic velocity and attenuation measurements give insight into materials microstructure and associated mechanical properties. Recent developments with laser beam non-contact generation and detection of ultrasound are presented. The results of several years of experimental measurements using high-power ultrasound are discussed, which provide substantial evidence of the inability of presently accepted theories to fully explain the interaction of ultrasound with solid materials. Finally, a special synchrotron X-ray topographic system is described which affords the possibility of observing direct interaction of ultrasonic waves with the microstructural features of real crystalline solid materials for the first time. Author

**N86-22964*#** Rockwell International Science Center, Thousand Oaks, Calif.

**ULTRASONIC CHARACTERIZATION OF MICROSTRUCTURE IN POWDER METAL ALLOY** **c71**

B. R. Tittmann, L. A. Ahlberg, and K. Fertig *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 31-47 refs (For primary document see N86-22962 13-38)

(Contract W-7405-eng-82)

Avail: NTIS HC A16/MF A01 CSCL 20A

The ultrasonic wave propagation characteristics were measured for IN-100, a powder metallurgy alloy used for aircraft engine components. This material was as a model system for testing the feasibility of characterizing the microstructure of a variety of inhomogeneous media including powder metals, ceramics, castings and components. The data were obtained for a frequency range from about 2 to 20 MHz and were statistically averaged over numerous volume elements of the samples. Micrographical examination provided size and number distributions for grain and pore structure. The results showed that the predominant source for the ultrasonic attenuation and backscatter was a dense (approx. 100/cubic mm) distribution of small micropores (approx. 10 micron radius). Two samples with different micropore densities were studied in detail to test the feasibility of calculating from observed microstructural parameters the frequency dependence of the microstructural backscatter in the regime for which the wavelength is much larger than the size of the individual scattering centers. Excellent agreement was found between predicted and observed values so as to demonstrate the feasibility of solving the forward problem. The results suggest a way towards the nondestructive detection and characterization of anomalous distributions of micropores when conventional ultrasonic imaging is difficult. The findings are potentially significant toward the application of the early detection of porosity during the materials fabrication process and after manufacturing of potential sites for stress induced void coalescence leading to crack initiation and subsequent failure. Author

**N86-22965*#** Cornell Univ., Ithaca, N.Y.

**STUDIES OF ACOUSTIC EMISSION FROM POINT AND EXTENDED SOURCES** **c71**

Wolfgang Sachse, Kwang Yul Kim, and C. P. Chen *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 49-59 refs Sponsored in part by NSF and Navy (For primary document see N86-22962 13-38)

Avail: NTIS HC A16/MF A01 CSCL 20A

The use of simulated and controlled acoustic emission signals forms the basis of a powerful tool for the detailed study of various deformation and wave interaction processes in materials. The results of experiments and signal analyses of acoustic emission resulting from point sources such as various types of indentation-produced cracks in brittle materials and the growth of fatigue cracks in 7075-T6 aluminum panels are discussed. Recent work dealing with the modeling and subsequent signal processing of an extended source of emission in a material is reviewed. Results of the forward problem and the inverse problem are presented with the example of a source distributed through the interior of a specimen. R.J.F.

**N86-22966*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**RESIDUAL STRESS MEASUREMENTS IN CARBON STEEL** **c71**

Joseph S. Heyman and Namkung Min (William and Mary Coll., Williamsburg, Va.) *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 61-74 refs (For primary document see N86-22962 13-38)

Avail: NTIS HC A16/MF A01 CSCL 20A

External dc magnetic field-induced changes in natural velocity of Rayleigh surface waves were measured in steel specimens under various stress conditions. The low field slopes of curves representing the fractional changes of natural velocity were proved to provide correct stress information in steels with different metallurgical properties. The slopes of curves under uniaxial compression, exceeding about one third of the yield stress, fell below zero in all the specimens when magnetized along the stress axis. The slopes under tension varied among different steels but remained positive in any circumstances. The stress effect was observed for both applied and residual stress. A physical interpretation of these results is given based on the stress-induced domain structure changes and the delta epsilon effect. Most importantly,

it is found that the influence of detailed metallurgical properties cause only secondary effects on the obtained stress information. Author

**N86-22967*#** Ohio State Univ., Columbus.
**ULTRASONIC MEASUREMENT OF POROSITY IN CASTS AND WELDS** c71
Laszlo Adler and Shaio-Wen Wang *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 75-81 refs (For primary document see N86-22962 13-38)
(Contract W-7405-eng-82)
Avail: NTIS HC A16/MF A01 CSCL 20A

The development of a quantitative nondestructive method which involves ultrasonic attenuation measurements in frequency domain to determine volume fraction of porosity in aluminum cast is discussed. The aluminum alloy A357 casting samples were produced at the Ohio State University Foundry with controlled porosity contents ranging from 0% to 6%. A computer controlled system was used to direct ultrasonic beam to a test sample to different places to conduct ultrasonic attenuation measurements. The plot of attenuation coefficients as a function of frequency was then evaluated based on existing theories to determine volume fraction of porosity and pore size. Author

**N86-22968*#** Johns Hopkins Univ., Baltimore, Md.
**ANALYTICAL ULTRASONICS FOR CHARACTERIZATION OF METALLURGICAL MICROSTRUCTURES AND TRANSFORMATIONS** c71
Moshe Rosen *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 83-102 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

The application of contact (piezoelectric) and noncontact (laser generation and detection) ultrasonic techniques for dynamic investigation of precipitation hardening processes in aluminum alloys, as well as crystallization and phase transformation in rapidly solidified amorphous and microcrystalline alloys is discussed. From the variations of the sound velocity and attenuation the precipitation mechanism and kinetics were determined. In addition, a correlation was established between the observed changes in the velocity and attenuation and the mechanical properties of age-hardenable aluminum alloys. The behavior of the elastic moduli, determined ultrasonically, were found to be sensitive to relaxation, crystallization and phase decomposition phenomena in rapidly solidified metallic glasses. Analytical ultrasonics enables determination of the activation energies and growth parameters of the reactions. Therefrom theoretical models can be constructed to explain the changes in mechanical and physical properties upon heat treatment of glassy alloys. The composition dependence of the elastic moduli in amorphous Cu-Zr alloys was found to be related to the glass transition temperature, and consequently to the glass forming ability of these alloys. Dynamic ultrasonic analysis was found to be feasible for on-line, real-time, monitoring of metallurgical processes. Author

**N86-22969*#** Argonne National Lab., Ill.
**ANALYTICAL ULTRASONICS FOR STRUCTURAL MATERIALS** c71
David S. Kupperman *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 103-115 refs Previously announced in IAA as N85-34600 Sponsored in part by NRC and DOE (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

The application of ultrasonic velocity and attenuation measurements to characterize the microstructure of structural materials is discussed. Velocity measurements in cast stainless steel are correlated with microstructural variations ranging from equiaxed (elastically isotropic) to columnar (elastically anisotropic) grain structure. The effect of the anisotropic grain structure on the deviation of ultrasonic waves in cast stainless steel is also reported. Field-implementable techniques for distinguishing equiaxed from columnar grain structures in cast strainless steel structural members are presented. The application of ultrasonic velocity measurements to characterize structural ceramics in the green state is also discussed. Author

**N86-22970*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ULTRASONIC CHARACTERIZATION OF STRUCTURAL CERAMICS** c71
Stanley J. Klima and George Y. Baaklini *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 117-126 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

Ultrasonic velocity and attenuation measurements were used to characterize density and microstructure in monolithic silicon nitride and silicon carbide. Research samples of these structural ceramics exhibited a wide range of density and microstructural variations. It was shown that bulk density variations correlate with and can be estimated by velocity measurements. Variations in microstructural features such as grain size or shape and pore morphology had a minor effect on velocity. However, these features had a pronounced effect on ultrasonic attenuation. The ultrasonic results are supplemented by low-energy radiography and scanning laser acoustic microscopy. Author

**N86-22971*#** Iowa State Univ. of Science and Technology, Ames.
**ON THE INTERACTION OF ULTRASOUND WITH CRACKS: APPLICATIONS TO FATIGUE CRACK GROWTH** c71
O. Buck, R. B. Thompson, and D. K. Rehbein *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 127-140 refs (For primary document see N86-22962 13-38)
(Contract W-7405-eng-82)
Avail: NTIS HC A16/MF A01 CSCL 20A

Partial contact of two rough fatigue crack surfaces leads to transmission and diffraction of an acoustic signal at those contacts. Recent experimental and theoretical efforts to understand and quantify such contact in greater detail are discussed. The objective is to develop an understanding of the closure phenomenon and its application to the interpretation of fatigue data, in particular the R-ratio, spike overload/underload and threshold effects on crack propagation. Author

**N86-22972*#** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**ANALYTICAL ULTRASONICS FOR EVALUATION OF COMPOSITE MATERIALS RESPONSE. PART 1: PHYSICAL INTERPRETATION** c71
Edmund G. Henneke, II and John C. Duke, Jr. *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 141-152 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

The phenomena associated with the propagation of elastic waves in anisotropic materials are discussed. Wave modes propagating in general directions relative to the material coordinate system are not purely longitudinal nor transverse. Hence the generation of ultrasonic waves by common piezoelectric transducers will generate multiple modes to some extent. The received signals will likely be a combination of different modes. When using two transducers to send and receive ultrasonic waves, deviation of the energy flux vector may reduce the apparent value of the received signal unless the proper orientation of the two transducers with respect to one another is taken into account. And application of reflection from plane boundaries for the purposes of making certain measurements may lead to misinterpretation of results unless one is aware of the differences in multiple mode generation and critical angle phenomena between isotropic and anisotropic materials. When studies or characterizations of composite materials by ultrasonics are to be performed, these phenomena must be taken into consideration so that proper and correct application and interpretation of the measurements can be made. Finally, attention must be drawn again to the fact that composite materials

are heterogeneous by definition. The results discussed here have been determined for homogeneous materials only. While the assumption of homogeneity appears to be valid for certain wavelength ranges in composites, future work must continue to study the phenomena of wave propagation in anisotropic, nonhomogeneous materials. Author

**N86-22973*#** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**ANALYTICAL ULTRASONICS FOR EVALUATION OF COMPOSITE MATERIALS RESPONSE. PART 2: GENERATION AND DETECTION c71**
John C. Duke, Jr. and Edmund G. Henneke, II *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 153-168 refs (For primary document see N86-22962 13-38)
(Grants NsG3-172; NAG3-323)
Avail: NTIS HC A16/MF A01 CSCL 20A

To evaluate the response of composite materials, it is imperative that the input excitation as well as the observed output be well characterized. This characterization ideally should be in terms of displacements as a function of time with high spatial resolution. Additionally, the ability to prescribe these features for the excitation is highly desirable. Various methods for generating and detecting ultrasound in advanced composite materials are examined. Characterization and tailoring of input excitation is considered for contact and noncontact, mechanical, and electromechanical devices. Type of response as well as temporal and spatial resolution of detection methods are discussed as well. Results of investigations at Virginia Tech in application of these techniques to characterizing the response of advanced composites are presented. Author

**N86-22974*#** Iowa State Univ. of Science and Technology, Ames.
**INFERENCE OF STRESS AND TEXTURE FROM ANGULAR DEPENDENCE OF ULTRASONIC PLATE MODE VELOCITIES c71**
R. B. Thompson, J. F. Smith, and S. S. Lee *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 169-180 refs (For primary document see N86-22962 13-38)
(Contract W-7405-eng-82)
Avail: NTIS HC A16/MF A01 CSCL 20A

The theory for the angular dependence of the ultrasonic wave velocity in a symmetry plane of an orthorhombic, stressed material is presented. The two waves having polarizations in this plane are shown to have velocities which can be estimated from measurements of the SH sub 0 and S sub 0 guided modes of a thin plate: the relationship being exact for the SH sub 0 mode and requiring a 10% correction for the S sub 0 mode at long wavelength. It is then shown how stress and texture can be independently inferred from various features of the angular dependence of these two velocities. From the SH sub 0 data, the ability to determine the directions and differences in magnitudes of principal stresses is described and supported by experimental data on several materials. From a combination of the SH sub 0 and S sub 0 data, a procedure is proposed for determining the coefficients W sub 400, W sub 420 and W sub 440 of an expansion of the crystallite orientation distribution function in terms of generalized Legendre functions. Possible applications in process control are indicated. Author

**N86-22975*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EFFECT OF STRESS ON ULTRASONIC PULSES IN FIBER REINFORCED COMPOSITES c71**
John H. Hemann (Cleveland State Univ., Ohio) and George Y. Baaklini *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 181-191 refs Previously announced in IAA as N83-33180 (For primary document see N86-22962 13-38)
(Grant NAG3-106)
Avail: NTIS HC A16/MF A01 CSCL 20A

An acoustical-ultrasonic technique was used to demonstrate relationships existing between changes in attenuation of stress waves and tensile stress on an eight ply 0 degree graphite-epoxy fiber reinforced composite. All tests were conducted in the linear range of the material for which no mechanical or macroscopic damage was evident. Changes in attenuation were measured as a function of tensile stress in the frequency domain and in the time domain. Stress wave propagation in these specimens was dispersive, i.e., the wave speed depends on frequency. Wave speeds varied from 267,400 cm/sec to 680,000 cm/sec as the frequency of the signal was varied from 150 kHz to 1.9 MHz which strongly suggests that flexural/lamb wave modes of propagation exist. The magnitude of the attenuation changes depended strongly on tensile stress. It was further observed that the wave speeds increased slightly for all tested frequencies as the stress was increased. Author

**N86-22976*#** Massachusetts Inst. of Tech., Cambridge.
**PATTERN RECOGNITION CHARACTERIZATIONS OF MICROMECHANICAL AND MORPHOLOGICAL MATERIALS STATES VIA ANALYTICAL QUANTITATIVE ULTRASONICS c71**
James H. Williams, Jr. and Samson S. Lee *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 193-205 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01

One potential approach to the quantitative acquisition of discriminatory information that can isolate a single structural state is pattern recognition. The pattern recognition characterizations of micromechanical and morphological materials states via analytical quantiative ultrasonics are outlined. The concepts, terminology, and techniques of statistical pattern recognition are reviewed. Feature extraction and classification and states of the structure can be determined via a program of ultrasonic data generation. R.J.F.

**N86-22977*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ULTRASONIC VERIFICATION OF MICROSTRUCTURAL CHANGES DUE TO HEAT TREATMENT c71**
Edward R. Generazio *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 207-217 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

Ultrasonic attenuation was measured for polycrystalline samples of nickel and copper with various grain-size distributions produced by heat treatment. Attenuation as a function of frequency was determined for a sample having a known mean grain diameter. Once this function was determined, it could be scaled to determine the mean grain size of other samples of the same material with different mean grain diameters. These results were obtained by using broadband pulse-echo ultrasound in the 25 to 100 MHz frequency range. The results suggest an ultrasonic, nondestructive approach for verifying heat treatment of metals. R.J.F.

**N86-22978*#** Lowell Univ., Mass.
**ULTRASONIC MATERIAL PROPERTY DETERMINATIONS c71**
Steven Serabian *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 219-232 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

The use and potential offered by ultrasonic velocity and attenuation measurements to determine and/or monitor material properties is explored. The basis for such unique measurements along with examples of materials from a variety of industries are presented. Author

**N86-22979*#** Ohio State Univ., Columbus.
**DYNAMIC MODULI AND LOCALIZED DAMAGE IN COMPOSITES c71**
L. S. Fu *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 233-256 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

The scatter of elastic waves due to a thin, flat ellipsoidal inhomogeneity, either penny shaped or elliptical is discussed. An average theorem appropriate for dynamic effective mass density and effective moduli was developed via a self-consistent scheme. Effective material properties of two-component media consisting of randomly distributed spheres are given here as a special case.
Author

**N86-22980*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**TRANSFER FUNCTION CONCEPT FOR ULTRASONIC CHARACTERIZATION OF MATERIAL MICROSTRUCTURES** **c71**
Alex Vary and Harold E. Kautz *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 251-297 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

The approach given depends on treating material microstructures as elastomechanical filters that have analytically definable transfer functions. These transfer functions can be defined in terms of the frequency dependence of the ultrasonic attenuation coefficient. The transfer function concept provides a basis for synthesizing expressions that characterize polycrystalline materials relative to microstructural factors such as mean grain size, grain-size distribution functions, and grain boundary energy transmission. Although the approach is nonrigorous, it leads to a rational basis for combining the previously mentioned diverse and fragmented equations for ultrasonic attenuation coefficients.
Author

**N86-22981*#** Ohio State Univ., Columbus. Dept. of Welding Engineering.
**ADHESIVE JOINT EVALUATION BY ULTRASONIC INTERFACE AND LAMB WAVES** **c71**
S. I. Rokhlin *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 299-310 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

Some results on the application of interface and Lamb waves for the study of curing of thin adhesive layers were summarized. In the case of thick substrates (thickness much more than the wave length) the interface waves can be used. In this case the experimental data can be inverted and the shear modulus of the adhesive film may be explicitly found based on the measured interface wave velocity. It is shown that interface waves can be used for the study of curing of structural adhesives as a function of different temperatures and other experimental conditions. The kinetics of curing was studied. In the case of thin substrates the wave phenomena are much more complicated. It is shown that for successful measurements proper selection of experimental conditions is very important. This can be done based on theoretical estimations. For correctly selected experimental conditions the Lamb waves may be a sensitive probe of adhesive bond quality and may be used or cure monitoring.
Author

**N86-22982*#** Massachusetts Inst. of Tech., Cambridge.
**INPUT-OUTPUT CHARACTERIZATION OF AN ULTRASONIC TESTING SYSTEM BY DIGITAL SIGNAL ANALYSIS** **c71**
James H. Williams, Jr., Samson S. Lee, and Hira Karagulle *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 311-339 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

Ultrasonic test system input-output characteristics were investigated by directly coupling the transmitting and receiving transducers face to face without a test specimen. Some of the fundamentals of digital signal processing were summarized. Input and output signals were digitized by using a digital oscilloscope, and the digitized data were processed in a microcomputer by using digital signal-processing techniques. The continuous-time test system was modeled as a discrete-time, linear, shift-invariant system. In estimating the unit-sample response and frequency response of the discrete-time system, it was necessary to use digital filtering to remove low-amplitude noise, which interfered with deconvolution calculations. A digital bandpass filter constructed with the assistance of a Blackman window and a rectangular time window were used. Approximations of the impulse response and the frequency response of the continuous-time test system were obtained by linearly interpolating the defining points of the unit-sample response and the frequency response of the discrete-time system. The test system behaved as a linear-phase bandpass filter in the frequency range 0.6 to 2.3 MHz. These frequencies were selected in accordance with the criterion that they were 6 dB below the maximum peak of the amplitude of the frequency response. The output of the system to various inputs was predicted and the results were compared with the corresponding measurements on the system.
Author

**N86-22983*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**QUANTITATIVE FLAW CHARACTERIZATION WITH SCANNING LASER ACOUSTIC MICROSCOPY** **c71**
Edward R. Generazio and Don J. Roth *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 341-358 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

Surface roughness and diffraction are two factors that have been observed to affect the accuracy of flaw characterization with scanning laser acoustic microscopy. In accuracies can arise when the surface of the test sample is acoustically rough. It is shown that, in this case, Snell's law is no longer valid for determining the direction of sound propagation within the sample. The relationship between the direction of sound propagation within the sample, the apparent flaw depth, and the sample's surface roughness is investigated. Diffraction effects can mask the acoustic images of minute flaws and make it difficult to establish their size, depth, and other characteristics. It is shown that for Fraunhofer diffraction conditions the acoustic image of a subsurface defect corresponds to a two-dimensional Fourier transform. Transforms based on simulated flaws are used to infer the size and shape of the actual flaw.
Author

**N86-22984#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Product Assurance Systems Section.
**THE ESA PRODUCT ASSURANCE SPECIFICATION SYSTEM PSS-01 SERIES, EXPLANATORY NOTE**
Jul. 1985 8 p Previously announced as N85-13259 (ESA-PSS-01-Issue-7; ESA-PSS-01-Issue-6) Avail: NTIS HC A02/MF A01

The ESA product assurance specifications were rewritten and reidentified to fit into a three-level structure. The PSS-01-0 contains the basic requirements for product assurance and is the only document in the top level, i.e., level 1. Level 2 comprises 9 specifications each of which expands into detailed requirements a major discipline covered more generally in PSS-01-0. The remainder of the specifications are in level 3 and are supporting specifications, which cover methods, special processes, data, etc, and may be direct extensions of requirements in the level 2 specifications.
Author (ESA)

**N86-22985#** Rolls-Royce Ltd., Derby (England). Nondestructive Testing Div.
**LIMITATIONS OF MANUAL NDT SYSTEMS AND THE NO EYES CONCEPT**
R. G. Taylor 23 Jul. 1985 9 p
(PNR-90291) Avail: NTIS HC A02/MF A01

Defect tolerant design, particularly of aircraft components, and its links with nondestructive testing (NDT) are discussed. Engineering of the NDT technique, defect detection requirements, and human factors in the inspection cycle are considered.
Author (ESA)

# 39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

**N86-22986** Ohio State Univ., Columbus.
**FINITE ELEMENT RESPONSE MODELING OF CRACK GEOMETRIES INDUCED BY HYDRAULIC FRACTURING Ph.D. Thesis**
Hussien A. Khattab 1985 123 p
Avail: Univ. Microfilms Order No. DA8526195

The mechanics of hydraulic fracturnig generally entails the controlled pumping of the selected proppant laden fracture fluid in a borehole. A vertical fracture system is subsequently induced in the pay zone by the pressurized fluid. To date, a considerable amount of research was conducted to predict hydraulic fracture geometry. However, applications of finite element methodology to this problem were limited. The finite element formulations associated with the fluid pressure profiles and fracture geometry of the two dimensional model are presented. The fluid leak off in the formation and the role of both Newtonian and non-Newtonian fluids are included in the formulations. A computer code for predicting the fracture width, length, pressure profile, and stress intensity factors is developed. Numerical results for selected cases involving height containment due to discontinuous tectonic stress fields are presented. Comparisons with hydraulic fracture configuration simulations reported in recent literature are also presented.
Dissert. Abstr.

**N86-22987** Ohio State Univ., Columbus.
**THERMO-ELASTOPLASTIC ANALYSIS OF WORK-HARDENING MATERIALS USING THE FINITE ELEMENT METHOD Ph.D. Thesis**
Ali Mohamed Elrafei 1985 186 p
Avail: Univ. Microfilms Order No. DA8526173

Structural response evaluations of geological media and various engineering materials at elevated temperatures necessitate accurate determination of stress, strain and displacement fields. The thermo-elastoplastic response of a continuum is investigated by using the finite element method. Applications of this research to underground coal gasification are presented. The structure of the stress-strain relation is studied in the referential and spatial descriptions. Advantages and disadvantages of each description are delineated. A thermal cap model is proposed which takes into account the effect of temperature on the material properties in the plastic range. Temperature dependent material properties in the elastic domain are also included in the analysis. The finite element formulation is based on the principle of virtual work, the equilibrium and energy balance equations being uncoupled. The developed two-dimensional finite element code was evaluated against limiting cases available in the literature. Cases of large elastic deformations and elastoplastic behaviour under thermal and mechanical loads were investigated and excellent agreement is obtained.
Dissert. Abstr.

**N86-22988** Illinois Univ., Chicago.
**SUTURES IN STRETCHED MEMBRANES Ph.D. Thesis**
Ty-Ping Lee 1985 157 p
Avail: Univ. Microfilms Order No. DA8524811

General suture problem in neo-Hookean membranes was investigated. The constitutive equations for plane stress theory are expressed by complex variable notations. The holes with various kinds of geometries were generated by the conformal mappings. A suture function defining a one-to-one correspondence between the opposite sides of a hole is introduced. Successive substitutions were used to solve the large finite strain problems. An analytic solution is provided for the second approximation to the exact value. Fast convergence is guaranteed by the fact the membrane is everywhere in tension. Graphical results for deformations are available for miscellaneous situations. Certain symmetries can be predicted by physical intuition. Applications to surgical operations are possible by the parametric analyses of the solutions.
Dissert. Abstr.

**N86-22989** Illinois Univ., Chicago.
**A CONTINUUM DAMAGE THEORY OF CREEP FOR POLYCRYSTALLINE METALS AT ELEVATED TEMPERATURES Ph.D. Thesis**
Sebastine Selvaraj 1985 97 p
Avail: Univ. Microfilms Order No. DA8524816

A Continuum Damage Theory for time dependent deformation of polycrystalline metals at elevated temperatures is developed using the concept of internal state variables. Two sets of internal state variables, representing the viscous behavior caused by dislocations and the brittle phenomenon resulting from planar microcracks, were considered in the formulation. Thus the proposed theory is valid for materials ranging from perfectly brittle to purely ductile polycrystalline metals. The theory is based on the principles of thermodynamics using a rational form of Helmholtz free energy and a suitable flow potenial for isothermal cases with infinitesimal strains and small rotations. The validity of the theory is investigated by comparing the results with those available in literature. The proposed model leads to results which correlate well with experimental results for IN100.
Dissert. Abstr.

**N86-22990** Wisconsin Univ., Madison.
**CONSTITUTIVE RELATIONS AND FAILURE PREDICTIONS FOR NONLINEAR ORTHOTROPIC MEDIA Ph.D. Thesis**
Jeffrey Charles Suhling 1985 320 p
Avail: Univ. Microfilms Order No. DA8516793

The mechanical behavior of nonlinear orthotropic media under the action of uniaxial and biaxial states of loading was studied using experimental, analytical, and numerical techniques. Paper and paperboard were the particular materials considered. During the initial stage of the program, an extensive set of experimental biaxial failure data were used to evaluate and modify existing strength criteria. Later analytical work was concerned with forming and applying biaxial nonlinear elastic constitutive equations. Experimental data were gathered to evaluate the material coefficients present. Additional biaxial experiments have verified the adequacy of the model. The deformations of a uniformly loaded clamped circular paperboard plate (Mullen test) are determined by utilizing a nonlinear theory of elastic plates and the finite element method. The plate theory is an extension of the classical von Karman theory to accommodate anisotropic nonlinear behavior. Theoretical results correlated well with experimental data obtained using the optical method of shadow moire.
Dissert. Abstr.

**N86-22991** Case Western Reserve Univ., Cleveland, Ohio.
**CRACK LAYER ANALYSIS OF FATIGUE CRACK PROPAGATION IN STEELS Ph.D. Thesis**
Michael H. Bessendorf 1985 168 p
Avail: Univ. Microfilms Order No. DA8525250

Fatigue crack propagation experiments were performed on AISI 304 stainless and Fe3Si silicon iron steels; single edge notch specimens. An extensive damage zone consisting of slip bands, extrusions, and intrusions surrounds and precedes the propagating crack. The system of the crack and damage zone constitute the crack layer (CL). The results demonstrate that fracture propagates by the translation, expansion, and distortion of the part of CL called the active zone. Considerable differences in critical energy release rates are observed among specimens with different loading histories. This fact is attributed to the differences in the damage densities at the crack tip. Analysis of the results is carried out within the framework of CL theory. The crack growth rate and the rate of active zone expansion are considered thermodynamic fluxes. The path independent integrals J and M are parts of the conjugate thermodynamic forces. Stochastic and fractal analyses of the fracture surface were performed on two ensembles of AISI 304 steel samples. The fracture was shown to be strongly nonstationary. The correlation distance of the fracture process increases with the crack length. The fractal dimension of these trajectories were estimated.
Author

**N86-22992** Syracuse Univ., N. Y.
**STRESS ANALYSIS OF VARIABLE THICKNESS SANDWICH PLATES OF RECTANGULAR PLANFORM Ph.D. Thesis**
Nasser Hamed Paydar 1985 277 p
Avail: Univ. Microfilms Order No. DA8524435

A small deflection theory is presented for the stresses and deformations in variable thickness elastic sandwich plates that are symmetric about a middle surface. In this analysis, the face sheets are treated as membranes, the core is assumed to be inextensible in the thickness direction, to carry only transverse shear stress on its cross sections normal to middle surface, and to be deformable in transverse shear. The theory takes into account the contribution of the face sheet membrane forces (by virtue of their slopes) to the transverse shear. Thermal effects, due to heating or cooling the face sheets, as well as force loading are considered in this analysis. The special case of unidirectional thickness variation is considered separately from the general case of arbitrary thickness variation, for it is a common geometry and permits special solution techniques. Dissert. Abstr.

**N86-22993** Case Western Reserve Univ., Cleveland, Ohio.
**GENERAL LINEAR AND NONLINEAR TORSIONAL VIBRATION IN ROTOR SYSTEMS Ph.D. Thesis**
Fola Robert Soares 1985 366 p
Avail: Univ. Microfilms Order No. DA8525238

A general purpose rotor torsional vibrations computer code has been developed (STORV). This code embodies the state-of-the-art capability plus new developments not presently available in computer codes for torsional vibrations analysis and simulation. Accurate modeling of the rotor system including nonlinearities and component interactions and the development of algorithms to determine the total system dynamic response is provided. The finite element method (FEM) is the basic modeling technique. Parametric analysis of the rotor torsional dynamics with gear sets having tooth gear error is included. In summary the STORV code is configured to efficiently handle a wide range of specific problem and analysis types. Including: (1) system torsional natural frequencies (damped and undamped); (2) corresponding resonant mode shapes; (3) steady-state frequency-sweep analysis; (4) dynamically unstable operating speed ranges; (5) transient linear and nonlinear systems. Dissert. Abstr.

**N86-22994** Iowa State Univ. of Science and Technology, Ames.
**TRANSIENT THERMAL STRESS INTENSITY FACTORS OF NEAR SURFACE CRACKS Ph.D. Thesis**
Wei-Chung Wang 1985 149 p
Avail: Univ. Microfilms Order No. DA8524707

The stress intensity factors were determined or cracks near a boundary when they experience a sudden temperature change. Different isochromatic fringe patterns were observed for the two tips of the cracks, one near the boundary and the other away from the boundary. A combination of modern digital image analysis and the idea of half-fringe photoelasticity was adopted to collect data from experimentally obtained photographs of the transient event. The photoelastic analysis of a hybrid multiparameter-multipoint approach was employed. Three power series were used to describe the effects due to opening mode, sliding mode and far field stresses, respectively. The accuracy of fringe measurement was obtained by iteration of the measured results through pattern recognition software supported on a local image processing system. The use of up to four coefficients for each power series gave well matched results for both tips between the experimentally obtained fringe patterns and the fringes regenerated from substituting the experimentally determined coefficients for the power series into the generalized Westergaard's equations for crack tip stress fields. Dissert. Abstr.

**N86-22995** Leeds Univ. (England). Dept. of Mechanical Engineering.
**HIGH STRAIN-RATE PROPERTIES OF MATERIALS Progress Report, 31 May 1985**
J. L. Sturges, M. S. Bingley, B. Parsons, and B. N. Cole 1985 60 p refs
(Contract RARDE-2062/0111)
(BR96910) Avail: Issuing Activity

Vanadium free steel torsion specimens were re-heat-treated and tested. A flying wedge test facility was improved. Equivalent stress at instability and instability strains form a recognizable pattern. However, the observed instability strains, while following the general trend predicted by the carbide dissolution mode, are lower than those predicted, when calculated assuming homogeneous plastic deformation. White zones form in all test pieces. Metallographic examination shows that the local plastic strains in these regions are considerably higher than the calculated homogeneous plastic strains. Microhardness surveys show white zone hardness values of up to 690 HV, more than twice the value of as-quenched steel. Author (ESA)

**N86-22996** National Physical Lab., Teddington (England). Div. of Materials Applications.
**IMPACT ANALYSIS OF ORTHOTROPIC PLATES**
D. H. Ferriss Sep. 1985 43 p refs
(NPL-DMA(A)-107; ISSN-0143-7313) Copyright. Avail: Issuing Activity

Motion subsequent to a mass striking transversely a simply supported rectangular orthotropic plate was analyzed. A nonlinear contact law between impactor and plate was assumed, with the effect of gravity on the impactor included. Deflections of the plate were assumed small so that linear plate theory is applicable. The analysis results in a nonlinear integral equation for the time variation of the contact force. This integral equation is solved numerically allowing for multiple contact situations. Author (ESA)

**N86-22997*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**EXPERIMENAL AND ANALYTICAL GENERIC SPACE STAION DYNAMIC MODELS**
W. Keith Belvin and Harold H. Edighoffer (Edighoffer, Inc.) Mar. 1986 90 p refs
(NASA-TM-87696; NAS 1.15:87696) Avail: NTIS HC A05/MF A01 CSCL 20K

A dynamic model used for verification of analytical and experimental methods is documented. The model consists of five substructures to simulate the multibody, low frequency nature of large space structures. Design considerations which led to a fundamental vibration frequency of less than one Hz are described. Finite element analysis used to predict the vibration modes and frequencies of the experimental model is presented. In addition, modeling of cable suspension effects using prestressed vibration analysis is described. Details of the expermental and analytical models are included to permit replication of the study. Results of the modal vibration tests and analysis are presented in a separate document. Author

**N86-22998#** Purdue Univ., West Lafayette, Ind. School of Aeronautics and Astronautics.
**INITIATION, GROWTH AND COALESCENCE OF SMALL FATIGUE CRACKS Final Scientific Report, 14 Jan. 1982 - 14 Jan. 1985**
Alten F. Grandt, Jr. Jul. 1985 49 p
(Grant AF-AFOSR-0041-82)
(AD-A161305; AFOSR-85-0963TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

The objective of this effort was to determine the manner in which small fatigue cracks initiate at notches, extend by cyclic loading, interact with adjacent flaws, and coalesce into a single dominant crack which controls final fracture. The desired product was a predictive scheme capable of analyzing the early stages of fatigue crack growth which are characterized by the growth and link-up of small cracks. Research toward this goal was directed at the following tasks: (1) Crack Growth Predictive Algorithm - A computer program was developed to predict the growth and coalescence of multiple cracks located at notches; (2) Crack Interaction Analysis Stress intensity factors solutions were computed for multiple cracks located at an open hole. These solutions were required for the multiple crack growth algorithm; (3) Crack

Coalescence Experiments - Fatigue tests were conducted with multiply cracked specimens to provide a data base to evaluate the predictive model. The model was verified with large crack results directed toward coalescence aspects of the problem as well as small crack experiments which focused on the initial stages of fatigue crack growth; and (4) Characterization of Small Cracks - This phase of the effort was directed toward the growth and coalescence of physically small cracks, which were expected to behave differently than large cracks. GRA

**N86-22999#** Argonne National Lab., Ill.
**DYNAMIC PLASTIC DEFORMATION OF AN INFINITE PLATE**
C. K. Youngdahl 1985 8 p Presented at the 3rd Symposium on Energy Engineering Sciences: Thermofluids and Solid Mechanics, University Park, Pa., 8 Oct. 1985
(Contract W-31-109-eng-38)
(DE86-001801; CONF-8510176-2) Avail: NTIS HC A02/MF A01

A solution is derived for the dynamic plastic response of an infinite plate subjected to a general axisymmetric pressure pulse which varies both with position and time and is applied to a time-varying area of the plate. An approximation formula for the final plastic deformation is obtained in terms of three correlation parameters which are functions of simple integrals of the loading. The correlation parameters represent the effects of the applied impulse, the pulse shape, and the growth of the loaded region, respectively. DOE

**N86-23000#** Oak Ridge National Lab., Tenn.
**SECOND INTERNATIONAL CONFERENCE ON FUNDAMENTALS OF FRACTURE. PROGRAM AND ABSTRACT BOOK, SUMMARIES**
1985 197 p Conference held at Gatlinburg, Tenn., 4 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-001859; ORNL/TM-9783; CONF-851104-Summs) Avail: NTIS HC A09/MF A01

The approximately 95 papers and abstracts are grouped under the following headings: atomic theory, continuum theory, experimental studies, environmental effects, fatigue, ceramics, high-temperature phenomena, and interfacial fracture. DOE

**N86-23001#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
**TORNADO RISK ANALYSIS AT SAVANNAH RIVER PLANT USING WINDSPEED DAMAGE THRESHOLDS AND SINGLE BUILDING STRIKE FREQUENCIES**
D. H. Taylor, J. R. McDonald, and L. A. Twisdale 1985 24 p Presented at the DOE's Natural Phenomena Hazards Mitigation Conference, Las Vegas, Nev., 7 Oct. 1985
(Contract DE-AC09-76SR-00001)
(DE86-001972; DP-MS-85-42; CONF-8510118-8) Avail: NTIS HC A02/MF A01

In order to evaluate the safety of existing structures and properly design new structures, an analysis of tornado resistance was conducted on each process building at SRP and other buildings by type. Damage estimates were cataloged for each Fujita class windspeed interval and windspeeds were cataloged as a function of increased levels of damage. The probability, for any structure, of a tornado exceeding each windspeed threshold was calculated using the TORRISK computer code which was developed for calculating the probability of a tornado strike on nuclear power generating plants. DOE

**N86-23002#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
**STANDARDIZATION OF NATURAL PHENOMENA RISK ASSESSMENT METHODOLOGY AT THE SAVANNAH RIVER PLANT**
J. C. Huang and Y. S. Hsu 1985 12 p refs Presented at the DOE's Natural Phenomena Hazards Mitigation Conference, Las Vegas, Nev., 7 Oct. 1985 Prepared in cooperation with Georgia State Univ., Atlanta, Ga.
(Contract DE-AC09-76SR-00001)
(DE86-001977; DP-MS-85-47; CONF-8510118-7) Avail: NTIS HC A02/MF A01

Safety analyses at the Savannah River Plant (SRP) normally require consideration of the risks of incidents caused by natural events such as high-velocity straight winds, tornadic winds, and earthquakes. The probabilities for these events to occur at SRP had been studied independently by several investigators, but the results of their studies were never systematically evaluated. As part of the endeavor to standardize our environmental risk assessment methodology, these independent studies have been thoroughly reviewed and critiqued, and appropriate probability models for these natural events have been selected. The selected probability models for natural phenomena, high-velocity straight winds and tornadic winds in particular, are in agreement with those being used at other DOE sites, and have been adopted as a guide for all safety studies conducted for SRP operations and facilities. DOE

**N86-23003#** Sandia National Labs., Albuquerque, N. Mex.
**DATA REPORT TRUPACT-I, UNIT 0**
G. S. Mihalovich, M. Hudson, B. J. Joseph, and L. E. Romesberg Sep. 1985 312 p
(Contract DE-AC04-76DP-00789)
(DE86-002946; SAND-85-1695; TTC-0553) Avail: NTIS HC A14/MF A01

TRUPACT-I was tested to evaluate the design under the regulatory testing requirements defined in DOE Order No. 5480.1, Chapter 3. Tests were conducted both at the Drop Test Facility at Oak Ridge National Laboratories, Oak Ridge, Tennessee, and at Sandia National Laboratories, Albuquerque, New Mexico. The program consisted of 12-inch and 30-foot drop tests onto an essentially unyielding surface, 40-inch drop tests onto a puncture bar, and a thermal test. Instrumentation for the tests included accelerometers, strain gages, and thermocouples. Data from each test was stored on magnetic tape for later analysis. The test unit met all of the structural regulatory requirements during the impact events, with the possible exception of damage to the seal retainer bond line discovered during disassembly. The adhesive bonds on the seal retainer did not hold after the thermal test. The foam behind the puncture panel on the outer door burned during the thermal test, overheating and deteriorating the seals; the seals failed. This report presents the raw data from the testing program of TRUPACT-I, Unit 0. DOE

**N86-23004#** Sandia National Labs., Albuquerque, N. Mex.
**CONTINUUM DAMAGE MECHANICS STUDIES ON THE DYNAMIC FRACTURE OF CONCRETE**
E. P. Chen 1985 30 p refs Presented at the Cement-based Composites: Strain Rate Effect on Fracture Conference, Boston, Mass., 2 Dec. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002584; SAND-85-0908C; CONF-851247-1) Avail: NTIS HC A03/MF A01

The dynamic fracture of concrete in tension is studied by applying a continuum damage model. In this model, the degree of damage in concrete corresponds to the fraction of concrete volume that has been tension relieved, and tensile microcracking has been taken as the damage mechanism. In compression, the concrete is assumed to respond in an elastic/perfectly plastic manner. Strain-rate effects have been explicitly included in the model. Accumulation of damage in the material is reflected by the progressive weakening of the material stiffness. Examples involving center- and edge-cracked plate specimens subjected to the action of step and ramp loads are used to demonstrate the material responses predicted by the model. The bulk pressure versus strain relationships at locations close to the crack tip clearly show strain-softening behavior. The damage tends to localize around the crack and its extent in the specimen is dependent upon both the crack geometry and the loading type. These results are presented and their implications are discussed. The model has been successfully applied to predict the responses of oil shale in blasting operations. DOE

**N86-23005#** Denver Univ., Colo. Dept. of Physics.
**DETECTION OF HYDROGEN ASSISTED CRACK GROWTH Final Report**
S. H. Carpenter Sep. 1985 7 p

(Contract DE-AC02-81ER-10958)
(DE86-001881; DOE/ER-10958/4) Avail: NTIS HC A02/MF A01

Changes in the elastic modulus of pure iron due to cracking produced by cathodic charging have been measured and related to the density of cracking, the size of the cracks and the effective depth of cracking. The effects of experimental variables such as the vibratory strain amplitude, the charging current density sample size and mode of vibration have been determined. Effects of applied stress and test temperature have also been investigated. An added result of the modulus measurements has been the generation of complimentary internal friction data. The acoustic emission generated during the pressurization and subsequent pressure holds of small pressure vessels with a high pressure hydrogen and helium gas have been measured and characterized. The occurrence of cracking has been related to the production of measurable acoustic emission. To completely characterize the sources of measured acoustic emissions a variety of mechanical tests have been carried out. Double cantilever beam (DCB) specimens have been tested in different conditions to elucidate the acoustic emission from crack growth and to determine the effects of hydrogen environments. DOE

**N86-23006#** National Engineering Lab., East Kilbride (Scotland). Plastics Engineering Center.
**AXIAL BUCKLING OF REINFORCED PLASTIC CYLINDERS WITH SURFACE IMPERFECTION**
A. J. Wootton and G. D. Scowen Oct. 1983 31 p refs Sponsored by UK Department of Industry's Mechanical Engineering and Machine Tools Requirement Board
(NEL-687; ISSN-0305-1439) Avail: NTIS HC A03/MF A01

Theories of axial compression buckling in fiber-reinforced plastics circular cylinders are compared with experiment. Favorable agreement is established between theory that included surface imperfections and experimental buckling data. The surface imperfection measurement was in terms of root mean square of the random surface deviation from the nominal surface of the cylinder. Buckling results for glass, aramid, and hybrid carbon/glass fiber composite cylinders are included. Shell theory predicts higher buckling instability thresholds than experiments. Author (ESA)

**N86-23007#** National Engineering Lab., East Kilbride (Scotland). Service Loading Div.
**THE FATIGUE STRENGTH OF INTERNAL THREADS IN THREE MATERIALS**
J. E. Field Nov. 1983 24 p refs Sponsored by UK Department of Industry's Mechanical Engineering and Machine Tools Requirements Board
(NEL-689; ISSN-0305-1439) Avail: NTIS HC A02/MF A01

Repeated tension fatigue tests were carried out on 3/4 to 16 UNF internally threaded specimens in a 60:40 brass, a normalized En 8 steel and a hardened and tempered En 26 steel. Ground threads do not give as high a fatigue strength as tapped threads, despite having a better root form; this is attributed to beneficial cold working effects in thread tapping. Increasing the outside diameter of the specimen from 1.4 to 1.7 D, where D is the nominal thread diameter, does not increase the limiting fatigue load in proportion to the increase in cross-sectional area. Despite having nearly double the static strength of the En 8 specimens, the En 26 specimens with ground threads only has the same high cycle fatigue strength as the En 8 specimens with ground threads. A wide range of endurance was covered. Author (ESA)

**N86-23008#** General Electric Co., Whetstone (England). Mechanical Engineering Lab.
**EUROPEAN SPACE AGENCY THERMAL ANALYSIS NETWORK (ESATAN) Final Report**
J. R. Turner Paris ESA May 1985 26 p refs
(Contracts ESA-4791/81-NL-DK; ESA-5141/82-NL-PB(SC))
(GEC-MEL34.0582; ESA-CR(P)-2102; FR-ESATAN-007-A) Avail: NTIS HC A03/MF A01

The computer program ESATAN was developed for the thermal analysis of steady state and transient engineering problems. The development of the package and deliverable items are described. Standards used during the development, with recommendations for improvements, are outlined. Author (ESA)

**N86-23009#** Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
**CALCULATIONS OF A SELF SUPPORTING STANDARD SHELL OF UNUSUAL SHAPE [BEREKENINGEN AAN EEN ZELFDRAGENDE STANDAARDSCHAAL VAN ONGEBRUIKELIJKE VORM]**
A. W. M. Kok 1983 45 p In DUTCH
(ICES-STRUDL-83-8; B8575351) Avail: NTIS HC A03/MF A01

Strength calculations of a double crowned shell, used in series for modular constructions, were carried out. A number of load cases, i.e., shell weight, snow, wind, and the total load were applied. A preprocessor was written to determine the geometry of an arbitrary shell by means of a limited number of data. Load, stresses, moments, and cross forces in a number of cross sections were calculated, and the deformed geometry was plotted for each case. Author (ESA)

**N86-23010#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**AEROELASTIC RESEARCH ON WIND TURBINES Progress Report, 1 Jul. 1982 - 1 Jan. 1983 [ACHTSTE VOORTGANGSRAPPORT AERO-ELASTISCH ONDERZOEK AAN WINDTURBINES, PERIODE 1 JULI 1982 TOT 1 JANUARI 1983]**
W. Kuik and W. P. Koppens Jan. 1983 11 p refs In DUTCH
(VTH-M-450; PR-8) Avail: NTIS HC A02/MF A01

Results and developments of aeroelastic investigations of tip vane wind turbines are presented. Smoke and wool fiber experiments on blades and vanes show an increase of the mass flow through the turbine, but a release of the flow at the windward-side of blades and vanes, increase the resistance. The average torsion vibration spectrum at the blade root was measured for a number of rpm values. Differences in aerodynamic conditions cause large peak variations and distributions. Using a four degrees of freedom model to determine flap-torsion, lag-flap, and lag torsion stability of a tip vane rotor, calculations on an experimental tip vane turbine were carried out. Tip vane air forces appear to decrease the critical rpm by 10% to 15%, while it is hardly influenced by lag movements. Author (ESA)

**N86-23011#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**A FOUR DEGREES OF FREEDOM MODEL FOR THE AEROELASTIC STABILITY OF A WIND TURBINE BLADE [EEN VIER GRADEN VAN VRIJHEID-MODEL VOOR DE AERO-ELASTICHE STABILITEIT VAN EEN WINDTURBINE BLAD]**
W. Kuik Mar. 1983 65 p refs In DUTCH
(VTH-M-454) Avail: NTIS HC A04/MF A01

A model for the description of frequency and damping curves of a tip vane rotor as a function of the rpm was developed to predict rpm at which instabilities (flutter or divergence) might occur in an experimental tip vane wind turbine project. A model with four degrees of freedom, i.e., rotation out of the rotor plane, in the rotor plane, and in torsion direction, was used. Via the transformation matrix of the relation between the deformation of the rotating blade and an inert axis-system, Lagrange equations of motion were derived. Adding stiffness and damping values, axis mass, and quasi-stationary aerodynamic forces, a model for a rotor with and without tip vanes was derived. Author (ESA)

**N86-23012#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**AEROELASTIC RESEARCH ON WIND TURBINES Progress Report, 1 Jan. - 1 Jul. 1983 [NEGENDE VOORTGANGSRAPPORT. AERO-ELASTISCH ONDERZOEK AAN WINDTURBINES PERIODE 1 JANUARI TOT 1 JULI 1983]**
W. Kuik and W. P. Koppens Jun. 1983 5 p refs In DUTCH
(VTH-M-474; PR-9) Avail: NTIS HC A02/MF A01

Results and developments of aeroelastic investigations of tip vane wind turbines are presented. Aerodynamic (transfer) flow pieces were applied in the sharp angles between tip vanes and blades to reduce resistance caused by flow release. Analysis of

the power curve shows a flow resistance reduction. Helicopter blades appear not to be optimal aerodynamically. Torsional stress measurements on the blade root show a higher flutter rpm, induced by a reduced aerodynamic load of the tip vane. Programs to predict ground resonances and whirl-flutter of a two bladed rotor on a pylon with symmetric stiffness were developed. The programs are part of a stability program which describes a flexible rotor on a flexible pylon. Author (ESA)

**N86-23013#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**MEP: A PROGRAM FOR CROSS SECTION MAGNITUDES OF A MULTICELL WING PROFILE [M.E.P. - EEN PROGRAMMA VOOR DOORSNEDEGROOTHEDEN VAN EEN MEERCELLIG VLEUGELPROFIEL]**
P. A. Joosse Oct. 1983 49 p refs In DUTCH
(VTH-M-487) Avail: NTIS HC A03/MF A01

Based on undisturbed thin walled multicell closed cross sections, an interactive program for the determination of the center of gravity, stress center, shear center, and torsional stiffness of wind turbine blades was developed. In the case of bending it is assumed that the cross sections stay plane, and stress is proportionate to elasticity (Hookes law). Based on the Saint Venant principle, the shear center was calculated using shear flow caused by cross forces. Wing profiles with a thickness/chord ratio < 0.20 were assumed. Magnitudes of a three cell hexagon and a Kevlar NACA 23000 profile for tip vanes were calculated.
Author (ESA)

**N86-23014#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**AEROELASTIC RESEARCH ON WIND TURBINES Progress Report, 1 Jul. 1983 - 1 Jan. 1984 [TIENDE VOORTGANGSRAPPORT. AERO-ELASTISCH ONDERZOEK AAN WINDTUBINES PERIODE 1 JULI 1983 TOT 1 JANUARI 1984]**
W. P. Koppens and W. Kuik Jan. 1984 7 p refs In DUTCH
(VTH-M-501; PR-10) Avail: NTIS HC A02/MF A01

Tip vane flow resistance was investigated, replacing blades by pipes. Experiments show resistances on the windward side, leading to malfunctioning of the turbine. A cross flow to which the helicopter wing profile used is sensitive was established. Aeroelastic wind tunnel model experiments were started. The importance of stall flutter at tip vane rotors is shown. From calculations it appears that the stability of the rotor can be increased by the application of flapping hinges in the blade root, giving the generator a rotation direction opposite to the rotor, and placing the rotor behind the pylon. Author (ESA)

**N86-23015#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**EVALUATION OF THE CAPABILITIES OF SUPERCOMPUTERS FOR SHELL COLLAPSE LOAD CALCULATIONS**
J. Arbocz, T. J. vanBaten, and R. Llurba Apr. 1984 12 p refs In DUTCH
(VTH-M-505) Avail: NTIS HC A02/MF A01

The use of supercomputers in investigations of form impurities involved in the collapse of pressure loaded shell constructions was examined. Two programs, Extended Analysis and STAGS were tested on a CRAY-1. Extended Analysis, which determines the crack load of shells, was tested usng a parallel shooting method to resolve a nonlinear two point limiting condition problem; STAGS, a finite difference method for thin walled shells, was tested by transforming the problem into a large system of nonlinear equations, solved per block using iteration. Vectorization and optimization applications were tested. The computer considerably reduces investigation time. Author (ESA)

**N86-23016#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**AEROELASTIC RESEARCH ON WIND TURBINES Progress Report, 1 Jan. - 1 Jul. 1984 [ELFDE VOORTGANGSRAPPORT. AERO-ELASTISCH ONDERZOEK AAN WINDTURBINES. PERIODE 1 JANUARI 1984 TOT 1 JULI 1984]**
W. P. Koppens and W. Kuik Jun. 1984 9 p refs In DUTCH
(VTH-M-517; PR-11) Avail: NTIS HC A02/MF A01

Results and developments of aeroelastic investigations of tip vane wind turbines are presented. The Liebeck (Kolibrie helicopter) wing profile was replaced by a NACA-23012 and a profile specially developed for tip vanes. The Liebeck profile is sensitive to disturbances (torsion) reducing the power coefficient. Flow resistance experiments show that the resistance is caused by viscous and induced resistances. Power curves of a one-blade rotor with and without tip vane were determined in a wind tunnel. The neglect in aeroelastic literature of the contribution of the dynamic profile curvature in case the angle of attack is used instead of the 3/4 chord point appears not permissible.
Author (ESA)

# 42 GEOSCIENCES (GENERAL)

**N86-23017#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: EARTH SCIENCES Abstracts Only**
31 Mar. 1986 56 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-86-004) Avail: NTIS HC A04/MF A01

Progress is reported in U.S.S.R. earth sciences. Topics discussed include (1) meteorology; (2) oceanography; (3) terrestrial geophysics; (4) atmospheric physics; and (5) artic and antarctic research. For individual titles, see N86-23018 through N86-23024.

**N86-23018#** Joint Publications Research Service, Arlington, Va.
**SELECTION OF METHOD FOR CALCULATING SCATTERING OF IMPURITIES IN ATMOSPHERE IN STANDARDIZING RELEASE OF RADIONUCLIDES FROM HIGH SOURCES Abstract Only** **c45**
N. Ye. Artemova *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 2 Transl. into ENGLISH from Atomnaya Energiya (Moscow, USSR), v. 59, no. 3, Sept. 1985 p 216-221 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

Well-established methods existing in the USSR for calculating necessary smokestack height and maximum admissible emissions to maintain the maximum admissible concentration of harmful substances near the ground in the area surrounding an industrial enterprise or power plant for chemical substances and compounds for which maximum admissible concentrations exist. This article discusses methods suitable for making equivalent determination for radioactive elements. The modifications of the Gaussian model of dispersion of radionuclides around a source utilized in the USSR have not been tested at specific sites or in special experiments. The method of calculating the dilution factor developed by the State Committee for Hydrometeorology is recommended for formulating methods for standardizing the emission of radionuclides. The method is oriented toward definition of scientifically well-founded emission levels to assure radiation safety standards are not exceeded under any weather conditions. All types of continuously acting high sources are covered by the method. Details of the method are not described. Author

**N86-23019#** Joint Publications Research Service, Arlington, Va.
**CRUSTAL MODELS FOR VARIOUS PACIFIC OCEAN BED STRUCTURES Abstract Only** **c46**
G. I. Semenova *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 16 Transl. into ENGLISH from Tikhookeanskaya Geologiya (Novosibirsk, USSR), no. 4, Jul. - Aug. 1985 p 3-12 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

A comparison of seismic data in order to study lateral heterogeneities in crustal structure is possible only using the major parameters revealed by a variety of field methods and various interpretation approaches. This article summarizes deep seismic sounding data from the Pacific Ocean crust and suggests a plan

for regionalization of the crust reflecting the major features of its lateral heterogeneity. In the process of summarizing the seismic materials, histograms of values of crustal parameters of individual geomorphological structures were first constructed, then groups of structures were studied with similar distributions of parameters. The regionalization map, together with models of the crust in the areas in question, reflects the essential lateral heterogeneity of the Pacific Ocean floor crust and represents a three-dimensional model at the present level of understanding. Author

**N86-23020#** Joint Publications Research Service, Arlington, Va.
**NEW DATA ON DEEP STRUCTURE OF MID-ATLANTIC RIDGE AT 20 DEG S Abstract Only** **c48**
Yu. M. Pushcharovskiy, I. N. Yelynikov, and A. S. Perfilyev *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 21 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 5, Sep. - Oct. 1985 p 5-13 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

Results are presented from processing and interpretation of data on deep multichannel seismic profiling by the reflected waves method over the Mid-Atlantic ridge at 20 deg S during the seventh cruise of the research vessel Professor Shtokman. Total profile length was 293 km. The deep structure of the ridge is similar to the structure of the ridge in other areas, with significant differences. Volcanic cones with lava flows are clearly visible on the ridge slopes. Differences from other sections are discussed and two segments of the seismic profile are presented. The most clearly seen specific feature of the profile consists of zones of hard-plate deformations superimposed on the structure of the third layer in the central and partially in the western segments of the profile. These structures clearly dip to the east and remain within the third layer. The structures may have developed in the process of folding of the third layer of the oceanic crust beneath the axial zone of the ridge, but their genesis cannot be precisely determined at present. Author

**N86-23021#** Joint Publications Research Service, Arlington, Va.
**HYDROCARBON GAS-HYDRATE FORMATION BENEATH BOTTOM OF SEAS AND OCEANS Abstract Only** **c48**
V. Ya. Trotsyuk and I. A. Nemirovskaya *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 27 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), vol. 284, no. 4, Oct. 1985 p 976-978 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

The predictions of the early 1970's that there might be zones of hydrocarbon gas-hydrate formation beneath the ocean floor, a new type of nontraditional fuel-energy resource for the planet, have been confirmed. Data from recent marine expeditions by the authors are presented, indicating that formation of these zones in the ocean is controlled by thermodynamic factors and genetic factors, i.e., the scale of the gas generation processes. Gasometric and biogeochemical measurements were conducted using sealed sampling devices and high-precision express analyzers on a cruise in 1982 around the northern rim of the Pacific Ocean in an area selected to determine the nature of hydrocarbon gas saturation of bottom sediments. It is concluded that components migrate into the bottom environment over a focal area, bringing in additional nutrient matter and energy and stimulating the vital activity of microorganism and resulting in biogenic concentration of organic matter, including hydrocarbon gases. The increase in gas content in deep intervals of sediment columns indicates that in deeper sedimentary horizons under the necessary conditions of temperature and pressure, saturation of polar water with hydrocarbons could occur, creating the genetic conditions for development of gas formation zones. Author

**N86-23022#** Joint Publications Research Service, Arlington, Va.
**NORTH ATLANTIC UPPER MANTLE HETEROGENEITIES Abstract Only** **c48**
N. Ya. Kunin and S. V. Usenko *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 31 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 9, Sep. 1985 p 23-35 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

It is demonstrated that in much of the North Atlantic elastic wave boundary velocity values remain constant on profiles with differing orientation. Studies of the anisotropy of elastic wave boundary velocities are not useful in such areas. Regionalization of the North Atlantic based on these velocity values reveals three major areas differing in mean and modal velocities and distribution of velocities. It is found tha heat flow, gravity anomalies and regional anomalies of the geoid correlate with these three areas, probably reflecting large lateral heterogeneities in the upper mantle, though they do not coincide with the continental margins or mid-oceanic ridge boundaries. The results are compared with regionalization of other geophysical parameters. The upper mantle of the North Atlantic and adjacent continental areas can be characterized by a single zonality, the areas distinguished in the homogeneous mantle generally continuing beyond the limits of the continents essentially unchanged. Author

**N86-23023#** Joint Publications Research Service, Arlington, Va.
**HYDROCHEMICAL INDICATORS OF FRONTAL CYCLONIC EDDY IN ANTARCTIC CIRCUMPOLAR CURRENT Abstract Only** **c47**
A. M. Chernyakova and S. O. Bordokin *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 41 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 25, no. 5, Sep. - Oct. 1985 p 740-743 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

The 30th cruise of the research vessel Dmitriy Mendeleyev studied synoptic variability of physical, chemical and biological parameters in sea water in relationship to eddy formation in the area of the Antarctic Circumpolar Current south of New Zealand. Analysis of the materials revealed an eddy formation, a cyclonic frontal ring, its area of formation and the evolution of its waters in time and space. The frontal cyclone was formed by separation of a meander of the southern branch of the Antarctic Circumpolar Current, then moved under the influence of the average current to the northeast, carrying an Antarctic water mass in its core. Meandering of the current is primarily related to bottom topography and is a constant source of eddies. Author

**GEODYNAMIC RECONSTRUCTIONS AS METHOD FOR PREDICTING OIL AND GAS CONTENT OF POORLY STUDIED REGIONS (AS EXEMPLIFIED BY ANTARCTIC) Abstract Only** **c43**
Ye. R. Aliyeva and Ye. V. Kucheruk *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 43 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Geologicheskaya (Moscow, USSR), no. 9, Sep. 1985 p 100-110 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

Geodynamic reconstruction based on plate tectonics, in contrast to other geological analogy geological methods, allows the drawing of conclusions not only on the current status, but also the history of geological development of a region. This article demonstrates the capabilities and limitations of application of the method in the example of the least studied continent, Antarctica. The broad stratigraphic diversity of the sedimentary cover, great thickness of sediments and presumably great variety of conditions for oil and gas formation and accumulation, allow the shelf and transition zones of the Weddell Sea to be considered among the most highly promising in the Antarctic for the search for oil and gas. The use of the geodynamic reconstruction method based on lithospheric plate tectonics, even when direct correlation across the ocean is impossible, allows general prediction of the types of basins of poorly studied Antarctic continental margins, the specifics of their geological structure, age and nature of sedimentation and possible conditions of oil and gas formation. Author

# 43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

**N86-23025#** Sherbrooke Univ. (Quebec). Dept. de Geographie.
**THE FUNDAMENTALS OF MICROWAVE REMOTE SENSING [LES MICRO-ONDES EN TELEDETECTION]**
Paul Desfosses, Jean-Marie M. Dubois, and Ferdinand Bonn Oct. 1985 126 p refs In FRENCH; ENGLISH summary
(SU-84; SU-85; ISSN-0710-0868) Avail: NTIS HC A07/MF A01

Fundamentals of microwave remote sensing are presented. It is noted that there is a need for a simple introduction to this specialized subject. The fundamentals of microwave physics are introduced. Radar systems, wave interaction with natural surfaces and interpretation of radar imagery are discussed. E.A.K.

**N86-23026#** Kilkeary, Scott and Associates, Inc., Annapolis, Md.
**REDUCING THE VARIABILITY IN MONTE-CARLO ITERATIONS OF OUTER CONTINENTAL SHELF MODEL Final Report**
11 Oct. 1985 58 p
(Contract DE-AC01-80EI-10643)
(DE86-002043; DOE/EI-10643/T1) Avail: NTIS HC A04/MF A01

The major issues addressed are suggestions for improving the experimental design of the Monte-Carlo simulations used in the Outer Continental Shelf Model. The objective then is to reduce the variability arising from the sampling of remaining resources. The major recommendations may be summarized as: use of a modified Latin Square experimental design for the Monte-Carlo sampling of resources; an increase in the internal simulation run size (i.e., the number of records in the Field Locator) from 10 to 20; and an increase of external simulation run size from 50 to 100. DOE

**N86-23027#** Sandia National Labs., Albuquerque, N. Mex.
**STABLE-ISOTOPE STUDIES OF GROUNDWATERS IN SOUTHEASTERN NEW MEXICO**
S. J. Lambert 1985 23 p refs Presented at the Conference on the Rustler Formation, Carlsbad, N. Mex., 7 Mar. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002590; SAND-85-1978C; CONF-8503189-1) Avail: NTIS HC A02/MF A01

Oxygen-18/16 and deuterium/hydrogen ratio measurements have been made on groundwaters sampled according to specific field criteria applied during pump tests of the Rustler Formation (the uppermost Permian evaporite unit) in Nash Draw, a solution-subsidence valley west of the WIPP site in the northern Delaware Basin of southeastern New Mexico. Comparison of these data with similar measurements on other groundwaters from the northern Delaware Basin indicates two nonoverlapping populations of meteoric groundwaters in delta-0-18/delta-D space. Most of the Rustler waters in Nash Draw and at the WIPP site and older waters from the eastern two-thirds of the Capitan Limestone constitute one population, while unconfined groundwaters originating as observable modern surface recharge to alluvium, the near-surface Rustler in southwestern Nash Draw, and the Capitan in the Guadalupe Mountains (Carlsbad Caverns) constitute the other. The isotopic distinction suggests that Rustler groundwater in most of Nash Draw and at the WIPP site is not receiving significant modern meteoric recharge. A likely explanation for this distinction is that meteoric recharge to most of the Rustler and Capitan took place in the geologic past under climate conditions significantly different from the present. DOE

**N86-23028#** National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
**MAP DIGITIZATION OFFERS NEW POSSIBILITIES**
F. A. Gerritsen and H. J. Bos 6 Aug. 1984 13 p Repr. from De Ingenieur (Utrecht, Netherlands), v. 96, no. 94, Apr. 1984 p 26-29 In DUTCH; ENGLISH summary Presented at Royal Netherlands Institute of Engineering (KLvL) Digital Maps Symposium, The Hague, Netherlands, 8 Feb. 1984 Original contains color illustrations
(NLR-MP-84061-U; B8571449) Avail: NTIS HC A02/MF A01

Alternatives for the digitization of map information, its application possibilities, costs, and required efforts are discussed. Structured geographic data bases for map production offer a large range or possibilities, but require large personnel efforts. Simple interactive use for presentation purposes demands a less complicated way of digitization, but requires relatively expensive apparatus. An automated system for flight route planning is mentioned.
Author (ESA)

**N86-23029#** Construcciones Aeronauticas S.A., Madrid (Spain). Space and Systems Div.
**OUT OF PLANE COEFFICIENT OF THERMAL EXPANSION AND ITS INFLUENCE ON REFLECTOR THERMAL DISTORSIONS**
G. G. Reibaldi (ESA/ESTEC, Noordwijk, Netherlands), L. Fanchi (ESA/ESTEC, Noordwijk, Netherlands), P. Cordero, and M. Marchetti (Rome Univ., Italy) 1985 12 p refs Presented at 36th International Astronautical Federation Congress on Peaceful Space and Global Problems of Mankind, Stockholm, 7-12 Oct. 1985
(Contract ESA-5263/82-NL-GM)
(Preprint-IAF-85-221) Avail: NTIS HC A02/MF A01

A test program was carried out to measure the out of plane coefficient of thermal expansion (CTE) of spaceborne reflectors which require micron-order stability. Analytical models to predict the test results and to study the influence on the reflector thermal distortions were developed. Parametric studies to define the range of increasing importance for the out of plane coefficient of thermal expansion were carried out. Results show that finite element techniques can be reliably used for CTE prediction. The value of out of plane CTE is very high, aluminum dominated. Influence of the CFRP facing laminates translates into transverse effects higher than produced by aluminum alone, due to Poisson's ratio constraining effects. For antenna distorsions, simple models providing meaningful results can be made to support preliminary design phases. Author (ESA)

**N86-23030#** Office of Technology Assessment, Washington, D.C.
**OIL AND GAS TECHNOLOGIES FOR THE ARCTIC AND DEEP-WATER**
May 1985 235 p
(PB86-119948) Avail: NTIS HC A11/MF A01 CSCL 08I

Nearly 2 billion acres of offshore public domain is owned by the United States adjacent to Alaska and the lower 48 states. Much of the Nation's future domestic petroleum supply is expected to come from this area. Areas of highest potential apparently occur in deeper water and in the Arctic where operating conditions are severe, development costs high, and financial risks immense. As the pace of exploration increases in these frontier regions, questions arise about the technologies needed to safely and efficiently explore and develop oil and gas in harsh environments. The study explores the range of technologies required for exploration and development of offshore energy resources and assesses associated economic factors and financial risks. GRA

**N86-23031#** Geological Survey, Cheyenne, Wyo. Water Resources Div.
**WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1984 Annual Water-Data Report, 1 Oct. 1983 - 30 Sep. 1984**
S. A. Druse and S. J. Rucker Jun. 1985 482 p
(PB86-106127; USGS/WRD/HD-85/252; USGS/WDR/WY-84/1) Avail: NTIS HC A21/MF A01 CSCL 08H

Water resources data for the 1984 water year for Wyoming consists of records of stage, discharge and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 186 gaging stations; stage and contents for 14 lakes and reservoirs; water quality for 72 gaging stations, and 66 ungauged stations; and water levels for 4 observation wells. Also included are 32 crest-stage partial-record stations. GRA

**N86-23032#** Bureau of Mines, Amarillo, Tex. Helium Field Operations.
**HELIUM RESOURCES OF THE UNITED STATES, 1983**
R. D. Miller 1985 24 p
(PB86-107513; BM-IC-9028; LB-85-600006) Avail: NTIS HC A02/MF A01 CSCL 08G

The helium resources base of the United States was estimated by the Bureau of Mines to be 961 Bcf as of January 1, 1983. These resources are divided into four categories in decreasing degree of assurance of their existence: (1) helium in storage and in proved natural gas resources, estimated at 202 Bcf, (3) helium in possible natural gas resources, estimated to be 351 Bcf, and (4) helium in speculative natural gas resources, which makes up the remaining 137 Bcf. These helium resources are further divided into depleting, nondepleting, and stored classifications. These depleting resources are estimated to contain 789 Bcf of the total helium resource base. Helium resources contained in nondepleting natural gas resources, those in shut-in, abandoned, or otherwise nonproducing natural gas fields, are estimated to total 134 Bcf. There is 38 Bcf of helium in storage in the Federal Government-owned Cliffside Gas Field near Amarillo, TX. GRA

**N86-23033#** Geological Survey, Doraville, Ga. Water Resources Div.
**WATER RESOURCES DATA FOR UTAH, WATER YEAR 1984 Annual Water Data Report, 1 Oct. 1983 - Sep. 1984**
M. D. ReMillard, G. C. Andersen, G. A. Birdwell, and E. Hookano May 1985 473 p
(PB86-126968; USGS/WRD/HD-85/241; USGS/WDR/UT-84/1) Avail: NTIS HC A20/MF A01 CSCL 08H

Water resources data for the 1984 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; water levels and water quality of ground water. Discharge records for 221 gaging stations; stage and contents for 18 lakes and reservoirs; water quality for 48 hydrologic stations and 166 wells; miscellaneous temperature measurements and field determinations for 162 stations; and water levels for 36 observation wells are reported. GRA

**N86-23024#** Joint Publications Research Service, Arlington, Va.
**GEODYNAMIC RECONSTRUCTIONS AS METHOD FOR PREDICTING OIL AND GAS CONTENT OF POORLY STUDIED REGIONS (AS EXEMPLIFIED BY ANTARCTIC) Abstract Only**
Ye. R. Aliyeva and Ye. V. Kucheruk *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 43 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Geologicheskaya (Moscow, USSR), no. 9, Sep. 1985 p 100-110 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

# 44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

**N86-23034** New Mexico State Univ., University Park.
**PHOTOVOLTAIC MODELING Ph.D. Thesis**
Richard Moscatt Wabrek 1985 549 p
Avail: Univ. Microfilms Order No. DA8525440

A series of analyses and experiments were performed to identify the optimum circuit model for photovoltaic cells subject to concentrated irradiance levels and to evaluate the terrestrial, solar photon flux. The family of eight photovoltaic models consisting of the five-parameter model (parameters: generation current; dark current; junction parameter, A; series resistance; and shunt resistance) and its relevant degenerate versions was analyzed. The equations describing the current-voltage characteristic for members of this family were derived and employed to develop individual systems of boundary equations that describe model parameters in terms of measured quantities. The data analyzed consisted of thirty-nine current voltage curves made up of discrete data points. Three different silicon, p-n junction, photovoltaic cells were tested under constant irradiance levels and at constant operating temperatures. Published data for extraterrestrial, spectral, solar irradiance and an algorithm for atmospheric attenuation were employed to calculate spectral and integrated values of terrestrial solar photon flux as a function of the atmospheric/site parameters. Results of the simulations were used to examine the relationship between useful photon flux and total irradiance, the effects of environmental/site parameters on photon flux, and the limits on terrestrial, photovoltaic, energy conversion. Author

**N86-23035*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ASSESSMENT OF COMMERCIALLY AVAILABLE AND EXPERIMENTAL HYDROGEN ELECTRODES**
Jo Ann Charleston [1986] 9 p refs To be presented at the 32nd International Power Sources Symposium, Cherry Hill, N.J., 9-12 Jun. 1986; sponsored by Army
(NASA-TM-87264; E-2958; NAS 1.15:87264) Avail: NTIS HC A02/MF A01 CSCL 10A

NASA Lewis Research Center is currently involved in advanced cell component development for nickel-hydrogen cells and batteries. Long life, high energy density, improved performance and reliability are required for energy storage systems in future space missions. Commercially available as well as experimental hydrogen electrodes were assessed and copared to the state-of-the-art hydrogen electrode that is currently being used in nickel-hydrogen batteries. These electrodes were evaluated by scanning electron microscopy and standard electrochemical polarization measurements. Production variables such as Teflon content and platinum catalyst loading were considered in order to assess various hydrogen electrods with regard to the different electrode manufacturing processes. Author

**N86-23036#** Sandia National Labs., Albuquerque, N. Mex.
**MULTIFACTORIAL EXPERIMENTAL EVALUATION OF LOW RESISTIVITY Si CONCENTRATOR CELLS**
D. L. King 1985 7 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001912; SAND-85-1204C; CONF-851043-6) Avail: NTIS HC A02/MF A01

A detailed experimental evaluation of ASEC n/p textured Si concentrator cells has been completed. Cell measurements in conjunction with detailed modelling indicated that 21% efficient cells at 100X concentration are possible with current baseline technology. Front surface passivation was found to be the principal area for improvement, followed by the reduction of gridline metal/silicon contact recombination. These improvements should result in 22 to 23% efficiencies at 100 to 200X concentration. Achievement of Si concentrator cell efficiencies above 23% will require the development of thin lightly doped advanced Si devices. DOE

**N86-23037#** Sandia National Labs., Albuquerque, N. Mex.
**THERMAL CHARACTERIZATION OF FLAT-PLATE PHOTOVOLTAIC ARRAYS**
M. K. Fuentes 1985 6 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001914; SAND-85-1163C; CONF-851043-8) Avail: NTIS HC A02/MF A01

The net effect of an array's operating cell temperature on energy output can be characterized by a single effective cell temperature (ECT). ECT is that temperature at which an array would operate were it to operate at a constant cell temperature

and produce the same energy as it would in the natural environment. Since an array effectively produces all of its energy at ECT, an operating efficiency at ECT is also the overall efficiency of the array. A methodology for estimating ECT from the Nominal Operating Cell Temperature (NOCT)is presented. Also presented is new thermal model. The model has been incorporated into the photovoltaic (PV) performance model, PVFORM, and has been proven to be accurate to within 5 C. DOE

**N86-23038#** Sandia National Labs., Albuquerque, N. Mex.
**PHOTOVOLTAIC CONCENTRATOR RESEARCH PROGRESS**
D. E. Arvizu 1985 9 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001915; SAND-85-1268C; CONF-851043-7) Avail: NTIS HC A02/MF A01

A review of progress in the DOE sponsored, Sandia managed Photovoltaic Concentrator Research Project is provided. Research status, project goals and a discussion of concentrator economics is presented. Recent research accomplishments that will be discussed include 21% efficient baseline silicon cells by Applied Solar Energy Corporation and Sandia, 26% efficient GaAs cells by Varian Associates, and near 25% mechanically stacked multijunction GaAs/Si cells by Hughes Research, Applied Solar, and Sandia. In addition, improvements in breadboard module units (i.e. single lens/cell combination) such as a 19% GaAs unit by Varian and a near 17% silicon unit by ENTECH will be reviewed. It is concluded that the photovoltaic concentrator option is making excellent progress toward competitive cost-effectiveness and provides a strong photovoltaic alternative. DOE

**N86-23039#** California Univ., Berkeley. Lawrence Berkeley Lab.
**DEACTIVATION AND POISONING OF FUEL CELL CATALYSTS, REVISION**
P. N. Ross, Jr. Sep. 1985 39 p refs Presented at the 3rd International Symposium on Catalyst Deactivation and Poisoning, Berkeley, Calif., 19 Jun. 1985 Previously announced in IAA as N86-12521
(Contract DE-AC03-76SF-00098)
(DE86-001982; LBL-19766-Rev; CONF-850631-1-Rev) Avail: NTIS HC A03/MF A01

The unique aspects of catalysts in the electrical generating unit of fuel cells are discussed. Fuel cell catalysts suffer from deactivation and poisoning phenomena that are either identical to or strongly analogous to the processes which occur in heterogeneous catalysis. Fuel cell performance is degraded by poisoning from impurities, loss of surface area of noble metal, and physical deterioration of the catalyst structure. The fuel cell catalyst is an integral part of the physical structure of the electrical generator, and there are at present no designs which are able to employ catalyst regeneration. Therefore, catalyst deactivation and poisoning phenomena are even more serious technological problems in fuel cells than in conventional reactors. The deactivation and poisoning phenomena reviewed in this paper are: the poisoning of anode (fuel electrode) catalyst by carbon monoxide; the deactivation of the cathode (air electrode) catalyst by loss of Pt dispersion; and the deactivation of the cathode by corrosion processes. The fuel cell technology discussed in the context of this phenomena is the phosphoric acid fuel cell. The operating conditions for this technology are typically 180 to 210 C, 95 to 99% acid, and in pressurized versions 50 to 120 psig. DOE

**N86-23040#** Argonne National Lab., Ill.
**THREE-DIMENSIONAL THERMAL MODELING OF ELECTRIC VEHICLE BATTERIES**
J. Lee, K. W. Choi, N. P. Yao, and C. C. Christianson Oct. 1985 45 p
(Contract W-31-109-eng-38)
(DE86-002529; ANL-85-53) Avail: NTIS HC A03/MF A01

A generic three-dimensional thermal model was developed for analyzing the thermal behavior of electric-vehicle batteries. The model calculates temperature distribution and excursion of a battery during discharge, change, and open circuit. The model takes into account the effects of heat generation, internal conduction and convection, and external heat dissipation on the temperature distribution in a battery. The three-dimensional feature of the model permits incorporation of various asymmetric boundary conditions; thus the effects of cell orientation and packaging on thermal behavior can be analyzed for a multiple-cell battery pack. Various modes of boundary heat transfer such as radiation, insulation, and natural and forced convections were also included in the model. Model predictions agreed well with the temperature distributions measured in nickel/iron batteries. Application of the thermal model to a closely packed 330-Ah module of five cells indicated that excessive temperature rise will occur upon discharge. Forced air convection is not effective for cooling the module. DOE

**N86-23041#** Sandia National Labs., Albuquerque, N. Mex.
**ANODIC REACTIONS IN THE Ca/CaCrO4 THERMAL BATTERY**
R. A. Guidotti and F. W. Reinhardt Sep. 1985 29 p
(Contract DE-AC04-76DP-00789)
(DE86-002634; SAND-83-2271) Avail: NTIS HC A03/MF A01

The reaction of Ca with a CaCrO4-(LiCl-KCl eutectic) solution at temperatures of 400(0)C to 500(0)C was studied to better understand the nature of the chemical reactions and electrochemical processes that occur in the Ca/CaCrO4 thermal battery at the anode during activation and discharge. Limited tests also were conducted with a CaCrO4-(CaCl2-NaCl-KCl eutectic) solution at 550(0)C. Ca/CaCrO4 and CaLi2/CaCrO4 single cells were tested to observe the relative performance differences of Ca and CaLi2 anodes. The discharged cells were analyzed by optical microscopy, electron microprobe, Auger electron spectroscopy, and secondary-ion mass spectroscopy. These analytical data were used in conjunction with the results of chemical-reaction experiments to propose a discharge mechanism for the Ca/CaCrO4 thermal battery, consistent with experimental observations. DOE

**N86-23042#** Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
**WIND ENERGY TECHNICAL INFORMATION GUIDE**
Mar. 1985 107 p
(Contract DE-AC02-83CH-10093)
(DE85-002940; SERI/SP-271-2684) Avail: NTIS HC A06/MF A01

Background is provided on wind energy development, including history and current status. Topics covered include wind technology research and design, wind energy system development, wind energy resources and systems performance, economics and applications, and environmental, safety, and legal issues. Directories are provided listing research centers and m chnical information sources. Also listed are wind energy mode design tools. DOE

**N86-23043#** Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
**THERMODYNAMIC SYSTEMS ANALYSIS OF OPEN-CYCLE OCEAN THERMAL ENERGY CONVERSION (OTEC)**
B. K. Parsons, D. Bharathan, and J. A. Althof Sep. 1985 181 p
(Contract DE-AC02-83CH-10093)
(DE85-016867; SERI/TR-252-2234) Avail: NTIS HC A09/MF A01

This report describes an updated thermal-hydraulic systems analysis program called OTECSYS that studies the integrated performance of an open-cycle ocean thermal energy conversion (OTEC) plant, specifically, the effects of component performance, design parameters, and site specific resource data on the total system performance and plant size. OTECSYS can size the various open-cycle power cycle and hydraulic components. Models for the evaporator, mist eliminator, turbine-generator diffuser, direct-contact condenser, exhaust compressors, seawater pumps, and seawater piping are included, as are evaluations of the pressure drops associated with the intercomponent connections. It can also determine the required steam, cold seawater, and warm seawater flow rates. OTECSYS uses an approach similar to earlier work and integrates the most up-to-date developments in component

performance and configuration. The program format allows the user to examine subsystem concepts not currently included by creating new component models. It will be useful to the OTEC plant designer who wants to quantify the design point sizing, performance, and power production using site-specific resource data. Detailed design trade-offs are easily evaluated, and several examples of these types of investigations are presented using plant size and power as criteria. DOE

**N86-23044#** Westinghouse Research and Development Center, Pittsburgh, Pa.
**RESEARCH ON THE BASIC UNDERSTANDING OF HIGH EFFICIENCY IN SILICON SOLAR CELLS Final Report, 1 Dec. 1982 - 30 Nov. 1984**
A. Rohatgi, T. W. OKeefe, D. L. Meier, and P. Rai-Choudhury Sep. 1985 183 p
(Contract DE-AC02-83CH-10093)
(DE85-016870; SERI/STR-211-2766) Avail: NTIS HC A09/MF A01

High-efficiency silicon solar cells and cell efficiencies greater than 18% are achieved by employing innovative concepts of material preparation, cell design, and fabrication technology. Theoretical models for very high efficiency cell designs are developed designs experimentally verified, and the understanding of efficiency-limiting mechanisms such as heavy doping effects and bulk and surface recombination improved. Model calculations were made for optimum single- and multi-layer antireflective coatings. Consistent with the model calculations, a multilayer SiO2TiO2SiO2 A/R coating was fabricated. The model calculations and the experimental data were in excellent agreement. Also, 18% efficient solar cells were fabricated on 0.1 to 0.2 ohm-cm float-zone silicon by a combination of surface passivation and double-layer antireflective coating. An 18.3% efficient solar cell was fabricated on 0.25 ohm-cm Wacker float-zone silicon material having passivation and a double-layer AR coating. It was also shown that 0.4 keV hydrogen ion implantation in the web solar cells improves the efficiency, diffusion length, and the long-wavelength response of the cells. DOE

**N86-23045#** Chronar Corp., Princeton, N.J.
**RESEARCH ON HIGH-EFFICIENCY, SINGLE-JUNCTION, MONOLITHIC THIN-FILM AMORPHOUS SILICON SOLAR CELLS Annual Progress Report, 1 Oct. 1983 - 30 Sep. 1984**
Sep. 1985 159 p
(Contract DE-AC02-83CH-10093)
(DE85-016871; SERI/STR-211-2720) Avail: NTIS HC A08/MF A01

The research program in this work on high-efficiency, single-junction, monolithic thin-filmed amorphous silicon solar cells is divided into three major areas. The first concerns material problems associated with a-Si solar cells including materials research on active a-Si thin films (doped and undoped). Materials problems that are associated with nonsemiconducting contact layers, their preparation and their diffusional and chemical stability are investigated. Device-related problems are the subject of the second area of the program. Device analysis, modeling and optimization are studied. Research is conducted on the fabrication and analysis of monolithic submodules of a-Si solar cells. The third part of the program is the design, construction and operation of an in-line, multi-chamber deposition system. DOE

**N86-23046#** Pacific Northwest Lab., Richland, Wash.
**OBSERVATIONS OF WAKE CHARACTERISTICS AT THE GOODNOE HILLS MOD-2 ARRAY**
J. W. Buck and D. S. Renne Aug. 1985 77 p
(Contract DE-AC06-76RL-01830)
(DE85-018282; PNL-5565) Avail: NTIS HC A05/MF A01

The array of three MOD-2 wind turbines and two meteorological towers at Goodnoe Hills, Washington, provides an opportunity to evaluate turbine and wake interactions in a real environment. The triangular arrangement of the three turbines provides opportunities to study the effect of wakes on the performance of a downwind turbine at three different distances: 5, 7, and 10 rotor diameters (D), where 1 D is 300 ft. The information obtained from this test configuration is critical to future wind farm activities and is a key objective of the MOD-2 test program. This report describes the analysis of data measured at the turbines and towers from August 29 to November 12, 1982. The data are 2-min averages of 1-s values. Background flow characteristics were also examined to determine if flow variations across the site could mask wake measurements. For this analysis, one year's data gathered at the meteorological towers were analyzed. The results show some differences between characteristics measured at the towers, but these differences were not great enough to consider in evaluating wakes at the towers. DOE

**N86-23047#** Argonne National Lab., Ill.
**POST-TEST ANALYSES OF Na/S CELLS AND AQUEOUS BATTERIES**
J. E. Battles, J. A. Smaga, and J. J. Marr 1985 3 p Presented at the International Battery Testing Workshop, Heidelberg, West Germany, 29 Sep. 1985
(Contract W-31-109-eng-38)
(DE85-018441; CONF-8509154-2) Avail: NTIS HC A02/MF A01

Post-test examinations are conducted at Argonne National Laboratory to obtain quantitative information on electrode morphology, corrosion and degradation of the cell hardware, and mechanisms responsible for existing or future cell failures. These findings are reported to the organizations responsible for the construction of these cells and support their efforts in achieving improved cell performance, cycle life, and reliability. Results of post-test analyses of recent high-temperature sodium/sulfur cells, and of aqueous lead-acid and nickel/iron batteries are presented. In particular, the relationship between electrode performance and electrode morphology is examined for each of the three battery systems. DOE

**N86-23048#** United Technologies Corp., South Windsor, Conn. Power Systems Div.
**DEVELOPMENT OF MOLTEN CARBONATE FUEL CELL POWER PLANT TECHNOLOGY Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1984**
Oct. 1985 128 p
(Contract DE-AC21-79ET-15440)
(DE86-001004; DOE/ET-15440/1945; QTPR-18) Avail: NTIS HC A07/MF A01

This report summarizes the work performed to develop and verify the design of a prototype molten carbonate fuel cell stack which meets the requirements of a 1990's-competitive, coal-fired, electrical utility central station, or industrial cogeneration power plant. Fabrication of the cell components to be used in the 100-cell stack was completed successfully. Compressive creep of the anode to be used in the 100-cell stack was measured through 720 hours of testing at 1300(0)F. The data continue to support the creep resistance of this component. Anode and bubble barrier pore spectra data obtained after aging at 1300F confirmed the sintering resistance of these components. A parametric study of candidate separator material data obtained from retort corrosion tests was completed. Based on the study, cell testing of treated INCO 825 was begun. A 1000 hour cell test of Ni-201/316SS at accelerated test conditions showed no failure of this separator plate material. Single cell tests to evaluate Co-based and Ti-based alternate cathode materials were conducted. The cell test performance data and post test chemical analysis show both materials are unstable. Cell testing of a doped Fe-based cathode showed a reaction with the matrix used. A repeat test using a different matrix material is planned. Testing of the 20-cell Subscale Stack was completed on schedule following 2000 hours of operation. A post test analysis was begun in order to correlate the diagnostic test data with the physical evidence of component stability, including electrolyte containment. DOE

**N86-23049#** Exide Management and Technology Co., Yardley, Pa.
**TESTING, DATA ANALYSIS AND ENGINEERING SERVICES ON LEAD-ACID LOAD LEVELING BATTERIES Final Contract**

**Report, 1 Jan. 1984 - 30 Jun. 1985**
A. M. Chreitzberg 30 Jun. 1985 36 p
(Contract DE-AC04-76DP-00789)
(DE86-001133; SAND-85-7235) Avail: NTIS HC A03/MF A01

Preprototype 3100 Ah load-leveling cells, developed on ANL Contract 31-109-38-4951, have been cycled at 40 + or - 5 C on an 80% DoD, 2 cycles per day regime for 2340 cycles. Three of four competing designs continue to cycle, meeting all capacity and voltage requirements. This data at 40 + or - 5(0)C are compared to emerging cycle data from similar cells on test at ANL National Battery Test Laboratory at 50 and 60 C. Cycle life goals at 40 and 50 C have been met. Tests are continuing in an effort to demonstrate their equivalency to 4000 cycles at 25 C on the same regime. DOE

**N86-23050#** Nevada Univ., Las Vegas. Div. of Earth Sciences.
**GEOTHERMAL UTILIZATION PLAN, MARINE CORPS AIR-GROUND COMBAT CENTER, TWENTYNINE PALMS, CALIFORNIA Final Report, Mar. 1 - 1 Sep. 1985**
G. Ghusn, Jr. and T. Flynn Sep. 1985 47 p refs
(Contract DE-FG03-85SF-15555)
(DE86-001307; DOE/SF-15555/1) Avail: NTIS HC A03/MF A01

A preliminary engineering feasibility study of geothermal utilization was completed for the Marine Corps Air Ground Combat Center, Twentynine Palms, California. The study incorporated previous studies of the geology, geophysics, and environment performed for the Center. In addition, information about fuel consumption and current heating methodology was provided by the Center's personnel. This information was integrated with design assumptions based on the best estimates available for geothermal resource temperature and flow rate. The result of the study is a recommended pipeline alignment and suggested geothermal service area. The estimated costs for construction of the system range from $4.5 to $5 million. The estimated savings in offset natural gas consumption after capital recovery is $3.8 million over a twenty year period. DOE

**N86-23051#** Sandia National Labs., Albuquerque, N. Mex.
**PVFORM: A NEW APPROACH TO PHOTOVOLTAIC SYSTEM PERFORMANCE MODELING**
D. F. Menicucci 1985 6 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001752; SAND-85-2271C; CONF-851043-13) Avail: NTIS HC A02/MF A01

Over the past two years a number of studies have resulted in important changes in photovoltaic (PV) system simulation. For example, a Sandia National Laboratories (SNLA) study showed that the major cause of error in PV performance models is incorrect estimates of insolation in the plane of the array of the system under study. Other studies have resulted in improvements in the modelling of various array subsystems. SNLA has integrated improved modelling techniques into a simplified program named PVFORM that can be run on mainframe or personal computers. The new model simulates the hourly performance of a PV flat-plate system for a one-year period. Verification tests at SNLA have shown that predicted values from the PVFORM model are typically within 1% to 5% of measured values. This paper describes the PVFORM model and gives examples of its application to the design, testing, and evaluation of PV systems. DOE

**N86-23052#** Sandia National Labs., Albuquerque, N. Mex.
**TESTS OF NICKEL/HYDROGEN AND LEAD-ACID BATTERY SYSTEMS**
D. M. Bush 1985 5 p Presented at the Annual Battery and Electrochemical Energy Storage Contractors' Meeting, Washington, D.C., 18 Nov. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001916; SAND-85-2242C; CONF-851146-1) Avail: NTIS HC A02/MF A01

Sealed lead-acid batteries and nickel/hydrogen batteries are being developed. Both feature recombination of gases on overcharge. Cells and batteries were shipped to Sandia for evaluation and characterization. The work on the sealed lead-acid system has been completed, while the development of a terrestrial nickel/hydrogen system is ongoing. DOE

**N86-23053#** Sandia National Labs., Albuquerque, N. Mex.
**DESIGN CONSIDERATIONS FOR LARGE PHOTOVOLTAIC SYSTEMS**
G. J. Jones, H. N. Post, J. W. Stevens, and T. S. Key 1985 19 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002125; SAND-85-1189C; CONF-851043-14) Avail: NTIS HC A02/MF A01

The design of large photovoltaic systems has been the subject of many years of system and subsystem research. This research information can now be supplemented with data from numerous operating systems ranging in size from kilowatts to multi megawatts. The compilation of all results verify that the design process for the photovoltaic system is simple. Construction should be based on good engineering practice coupled with PV specific hardware and a few PV specific design guidelines. These guidelines include considerations related to the selection of collector type, hardware specification, array field configuration, and system installation and checkout. This paper presents a discussion of these photovoltaic specific design considerations. DOE

**N86-23054#** Sandia National Labs., Albuquerque, N. Mex.
**RELIABILITY OF PHOTOVOLTAIC SYSTEMS: A FIELD REPORT**
M. G. Thomas, M. K. Fuentes, C. Lashway, and B. D. Black 1985 6 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985 Prepared in cooperation with New Mexico Solar Energy Inst., Las Cruces and New Mexico Univ., Albuquerque
(Contract DE-AC04-76DP-00789)
(DE86-002130; SAND-85-1069C; CONF-851043-12) Avail: NTIS HC A02/MF A01

Performance studies and field measurements of photovoltaic systems indicate a 1 to 2% per year degradation in array energy production. The cause for much of the degradation has been identified as soiling, failed modules, and failures in interconnections. System performance evaluation continues to be complicated by the poor reliability of some power conditioning hardware that has greatly diminished the system availability and by inconsistent field ratings. Nevertheless, the current system reliability is consistent with degradation of less than 10% in 5 years and with estimates of less than 10% per year of the energy value for O and M. DOE

**N86-23055#** Johnson Controls, Inc., Milwaukee, Wis.
**RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1984**
D. E. Bowman Aug. 1985 52 p
(Contract W-31-109-eng-38)
(DE86-002548; ANL/OEPM-85-5) Avail: NTIS HC A04/MF A01

Major activities focused on during 1984 were: (1) continued work on the development of the lead/plastic composite (combo) positive grid; (2) develop a process that would produce active materials that were crack-free (flow through); (3) develop a cell design that is leak-free; (4) study and determine workable specifications for flow rate, flow pressure and material permeabilities so as to achieve significant gains in positive active material (PAM) utilization; (5) submit cell to NBTL to show proof-of-concept of the forced electrolyte flow through; (6) continue work on defining failure modes (Advanced-1); and (7) continue work on driving profile testing. DOE

**N86-23056#** Sandia National Labs., Albuquerque, N. Mex.
**INNOVATIVE DESIGNS FOR POWER CONDITIONING SUBSYSTEMS**
T. M. Calloway and J. E. Leeman 1985 15 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985

(Contract DE-AC04-76DP-00789)
(DE86-002913; SAND-85-1190C; CONF-851043-16) Avail: NTIS HC A02/MF A01

The results of an effort to develop innovative designs for three-phase inverters for photovoltaic arrays are discussed. The capacity of the inverters is 50kVa with 480V output. Methods of estimating efficiency, cost and grid compatibility of the inverters are presented. DOE

**N86-23057#** Texas Technological Univ., Lubbock. Atmospheric Science Group.
**CLOUD SHADING DIRECT SOLAR RADIATION MODEL FOR THE CROSBYTON SOLAR POWER PROJECT**
R. E. Peterson and D. J. Smalley Jun. 1985 123 p
(Contract DE-AC04-83AL-21557)
(DE86-000002; DOE/AL-21557/T2) Avail: NTIS HC A06/MF A01

The CSPP was initiated to study the feasibility of using hemispheric bowl solar collectors for power generation. A non-spectral direct solar radiation (DSR) model was developed to aid in determining whether there exists a preferred spacing of these solar collectors based solely on meteorological considerations. The DSR model is applicable to the Northern Hemisphere and, with a few adjustments, to the Southern Hemisphere. The DSR model considers the reduction of direct insolation through the atmosphere due to Rayleigh scattering, uniformly mixed gases, ozone, precipitable water, and aerosols. It incorporates geographical information along with temperature, dew point, barometric pressure, and visibility data, updated every 15 minutes. This clear sky DSR model was verified against actual direct insolation data. DOE

**N86-23058#** Oak Ridge National Lab., Tenn.
**PHOTOSYNTHETIC WATER SPLITTING FOR HYDROGEN FUEL SYNTHESIS**
E. Greenbaum 1985 4 p Presented at the GRI Basic Research Contractor's Review Meeting on Gaseous Fuel Synthesis From Inorganic Resources, Chicago, Ill., 16 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-000092; CONF-8510162-1) Avail: NTIS HC A02/MF A01

Three key advances in photosynthesis research are reported. A significant advance in microalgal water splitting has been made. In the linear, low-intensity region of the light saturation curves, equivalent solar conversion efficiencies of 10% have been measured. A technological advance in the ability to genetically screen individual algal colonies has been made. Successive subcultures of anaerobiosis-stressed Chlamydomonas reinhardtii exhibited enhanced capacity for photoproduction of hydrogen and oxygen. DOE

**N86-23059#** American Solar Energy Society, Boulder, Colo.
**PROGRESS IN SOLAR ENERGY. VOLUME 6: AGRICULTURE DIVISION**
1983 28 p Presented at the American Solar Energy Society Meeting, Minneapolis, Minn., 1 Jun. 1983
(Contract DE-FG03-83SF-11947)
(DE86-000186; CONF-830622-Pt-1) Avail: NTIS HC A03/MF A01

Solar energy systems with applications to agriculture are studied in these presentations. Separate indexing has been prepared for each report for inclusion into the Energy Data Base. DOE

**N86-23060#** Micronesia Bound, Inc., Nett Point, Hawaii.
**ARAMAS KAPW APPROPRIATE ENERGY DEMONSTRATION SITE Final Report**
1982 8 p
(Contract DE-FG03-80R9-50006)
(DE86-000347; DOE/R9-50006/T1) Avail: NTIS HC A02/MF A01

The Nett Point, Aramas Kapw Base Camp was used as a project to demonstrate the use of sun, wind, and water for energy. The project was to result in two wind-powered electrical systems supplemented with a solar cell array to provide power for lighting, radio communication, navigational beacon, refrigeration, etc. Young people were trained. Workshops were held on hydro power and solar energy. DOE

**N86-23061#** Argonne National Lab., Ill.
**ELECTRIC/HYBRID VEHICLE MODEL FOR ESTABLISHING OPTIMAL BATTERY REQUIREMENTS**
W. W. Marr and W. J. Walsh 1986 7 p Presented at the Society for Computer Simulation (SCS) Multiconference, San Diego, Calif., 23 Jan. 1986
(Contract W-31-109-eng-38)
(DE86-001791; CONF-860119-1) Avail: NTIS HC A02/MF A01

A microcomputer program (HELEN) for establishing battery requirements for a heat engine/battery hybrid vehicle is described. The program permits least-cost analyses to identify the optimum combination of battery and heat engine characteristics for different vehicle types and missions. It can also be used for cost comparisons between heat-engine vehicles, all-electric (battery) vehicles, and hybrid vehicles. Simplified models are used for the transmission, motor/generator, controller, and other vehicle components, while a rather comprehensive model is employed for the battery. The heat engine performance model is based on engineering data for a production engine. A series/parallel configuration for the hybrid vehicle system is presently simulated. Energy management in the operation of the vehicle depends on the specified mission requirements, type and size of the battery, allowable battery depth of discharge, type and size of the heat engine, and the energy management strategy used. The program is written in PL/I language and can be run interactively on an IBM PC, COMPAQ, or other compatible microcomputer. DOE

**N86-23062#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**PROPOSITION FOR THE MEASUREMENT OF POWER CHARACTERISTICS OF WIND TURBINES [EEN VOORSTEL VOOR HET METEN VAN VERMOGENSKARAKTERISTIEKEN VAN WINDTURBINES]**
W. Kuik Jul. 1983 24 p refs In DUTCH
(VTH-M-473) Avail: NTIS HC A02/MF A01

A method to measure the power curve and the curve of the dimensionless power as a function of the high speed of a tip vane rotor with blades of a certain angle (Cp-lambda curve), was developed. The standardized bin method demands a 3 month measuring period, too long for tip vane design. From rough data the dispersion in torque direction was made small, so that mediation in wind velocity direction yields a good estimate of the wind velocity related to the torque. In experimental tip vane turbine measurements, a large part of the Cp-lambda curves were determined in 15 min. Author (ESA)

**N86-23063#** Idaho Univ., Moscow. Dept. of Chemistry.
**IMPROVED ACID ELECTROLYTES FOR FUEL CELLS Final Annual Report, Jul. 1984 - Jul. 1985**
J. M. Shreeve Jul. 1985 48 p refs Sponsored by Gas Research Inst.
(PB86-125119; GRI-85/0166) Avail: NTIS HC A03/MF A01 CSCL 10B

Twenty-three new acids have been synthesized as improved electrolytes for fuel cells and with the exception of SF5CFHSO3H, CF3CFHSO3H, CF3CFHCF2SO3H, C6F5SO3H, (CF3)2P(0)OH and CF3P(O)(OH)2 which are currently being evaluated, the remainder are being stored for future evaluation. GRA

**N86-23064#** General Accounting Office, Washington, D. C. National Security and International Affairs Div.
**ARMY'S PROCUREMENT OF BATTERIES: MAGNESIUM VERSUS LITHIUM**
26 Sep. 1985 13 p
(PB86-110574; GAO/NSIAD-85-1:224; B-219919) Avail: NTIS HC A02/MF A01 CSCL 10C

The Army is in the process of switching from magnesium to lithium batteries, a change motivated by the magnesium battery's performance limitation at low temperatures and the operating capabilities of the lithium battery. GAO concludes that the

operational advantages of the lithium battery justifies this move. However, GAO was not able to confirm the validity of the Army's cost comparisons of the two batteries. GRA

**N86-22606#** AEG-Telefunken, Wedel (West Germany).
**DEVELOPMENTS OF SOLAR GENERATOR SUBSTRATES: SIMPLE ANTICHARGING (AC) AND CONDUCTIVE THERMAL CONTROL (TC) MATERIALS (GEO), AND SOME LEO ASPECTS**
W. Schmitz *In* ESA Proceedings of 3rd European Symposium on Spacecraft Materials in Space Environment Nov. 1985 p 133-141 refs (For primary document see N86-22593 13-18)
Avail: NTIS HC A13/MF A01

# 45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

**N86-23065** Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands).
**DETERMINATION OF CHIMNEY HEIGHT [BEPALING VAN DE SCHOORSTEENHOOGTE]**
P. J. H. Builtjes and R. A. J. Boelens Jul. 1984 79 p refs In DUTCH
(Lucht-28; ISBN-90-346-0311-3; B8473499) Copyright. Avail: Issuing Activity

A method for calculating chimney height with regard to air pollution was developed to adapt Dutch environmental legislation to surrounding countries. Based on the National Model and the Huygen method, average annual concentrations and higher percentile values are combined. Both methods are Gaussian plume models, describing the dispersion of chemically nonreactive matter from one chimney as a function of wind velocity and atmosphere stability. Correction rules for the calculation of heavy/wet plume effects and the impact of surrounding buildings are given.
Author (ESA)

**N86-23066#** Oak Ridge Gaseous Diffusion Plant, Tenn.
**CHARACTERIZATION OF THE SOLID, AIRBORNE MATERIALS CREATED WHEN UF6 REACTS WITH MOIST AIR FLOWING IN SINGLE-PASS MODE**
P. W. Pickrell Oct. 1985 35 p
(Contract DE-AC05-84OT-21400)
(DE86-002283; K/PS-1134) Avail: NTIS HC A03/MF A01

A series of experiments has been performed in which UF6 was released into flowing air in order to characterize the solid particulate material produced under non-static conditions. In two of the experiments, the aerosol was allowed to stagnate in a static chamber after release and examined further but in the other experiments characterization was done only on material collected a few seconds after release. Transmission electron microscopy and mass measurement by cascaded impactor were used to characterize the aerosol particles which were usually single spheroids with little agglomeration in evidence. The goal of the work is to determine the chemistry and physics of the UF6-atmospheric moisture reaction under a variety of conditions so that information about resulting species and product morphologies is available for containment and removal (knockdown) studies as well as for dispersion plume modeling and toxicology studies. This report completes the milestone for reporting the information obtained from releases of UF6 into flowing rather than static air.
DOE

**N86-23067#** Los Alamos National Lab., N. Mex.
**FURTHER ASSESSMENT OF FEM3: A NUMERICAL MODEL FOR THE DISPERSION OF HEAVY GASES OVER COMPLEX TERRAIN**
S. T. Chan and D. L. Ermak Oct. 1985 13 p refs Presented at the JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, Calif., 4 Nov. 1985
(Contract W-7405-eng-48)
(DE86-001905; UCRL-92497; CONF-8511110-3) Avail: NTIS HC A02/MF A01

FEM3 is a three-dimensional numerical model for simulating the atmospheric dispersion of heavy gases over complex terrain. During the past few years, FEM3 has been assessed, using data from the Burro and Coyote series of LNG spill experiments conducted by LLNL at China Lake, California. In general, the model has been found to perform very well and it greatly complements the field experiments in enhancing our understanding of the phenomena associated with LNG vapor dispersion, including gravity spreading, heating from the ground surface, and terrain effects. In this paper, the FEM3 model is further applied to simulate the dispersion of nitrogen dioxide (NO2) for one of the LLNL conducted nitrogen tetroxide (N2O4) spill tests and also to simulate the dispersion of propane gas for four of the refrigerated liquid propane spills conducted by SHELL Research Limited at Maplin Sands. The main purpose of the NO2 simulation is to demonstrate the heavy gas effects in this test and the latter simulations are for assessing the performance of the current model for simulating the dispersion of propane gas.
DOE

**N86-23068#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
**DOE/AMS AIR POLLUTION MODEL EVALUATION WORKSHOP: PROCEEDINGS OF VOLUME 1**
A. H. Weber and A. J. Garrett Jul. 1985 722 p Presented at the DOE/AMS Air Pollution Model Evaluation Workshop, Charleston, S.C., 23 Oct. 1984
(Contract DE-AC09-76SR-00001)
(DE86-002159; DP-1701-1; CONF-8410165-Vol-1) Avail: NTIS HC A99/MF A01

A workshop, the second in a series on the modeling of mesoscale dispersion of pollutants in the atmosphere, was held at Kiawah, South Carolina during October 23 to 26, 1984. The workshop was co-sponsored by the Department of Energy and the American Meteorological Society, and hosted by the Savannah River Laboratory. The first such workshop was held in 1980 and was attended by representatives of the DOE affiliated laboratories (Buckner, 1981). Because of the success of the first workshop, a steering committee met at DOE headquarters to formulate objectives for the second workshop. Individual papers are processed separately for the data bases.
DOE

**N86-23069#** Oak Ridge National Lab., Tenn.
**ANALYSIS OF (81)Kr IN GROUNDWATER USING LASER RESONANCE IONIZATION SPECTROSCOPY**
S. D. Kramer, G. S. Hurst, C. H. Chen, M. G. Payne, S. L. Allman, R. C. Phillips, B. E. Lehmann, H. Oeschger, H. H. Loosli, and R. D. Willis Oct. 1985 11 p Presented at the 3rd International Conference on Low-level Counting, Bratislava, Czechoslovakia, 21 Oct. 1985 Prepared in cooperation with Bern Univ., Switzerland, Atom Sciences, Inc., Oak Ridge, Tenn.
(Contract DE-AC05-84OR-21400)
(DE86-002214; CONF-8510205-1) Avail: NTIS HC A02/MF A01

A new analytical technique based on resonant ionization of krypton with a vacuum ultraviolet (VUV) laser source was used to determine low-level (81)Kr concentrations in groundwater. The long half-life (210,000 years) and low concentration (1.3 x 10(3) (81)Kr atoms per liter of modern water at 10(0)C) make the detection of (81)Kr by radioactive counting techniques extremely difficult. In this method, krypton gas was removed from water taken from an underground Swiss aquifer using standard cryogenic and chromatographic techniques. Stable krypton isotopes were then reduced by a factor of 10(7) by a two-stage isotopic enrichment cycle using a commercially available mass spectrometer. The enriched gas containing about 10(8) stable krypton atoms and about 10(3) atoms of (81)Kr was implanted into a silicon disc. This disc was then placed in the high vacuum final counting chamber and the krypton was released by laser annealing. This chamber contained a quadrupole mass spectrometer which used a pulsed VUV laser source as the ionizer. The measured signal indicated that the sample contained 1200 (+ or - 300) atoms of (81)Kr.
DOE

**N86-23070#** Argonne National Lab., Ill.
**POTENTIAL ADVANTAGES AND PITFALLS IN DETERMINING COST-EFFECTIVE EMISSION CONTROL STRATEGIES TO REDUCE ACID DEPOSITION**
D. G. Streets Nov. 1985 22 p Presented at the American Institute of Chemical Engineers Annual Winter Meeting, Chicago, Ill., 10 Nov. 1985
(Contract W-31-109-eng-38)
(DE86-001794; CONF-851123-2) Avail: NTIS HC A02/MF A01

The advantages and disadvantages of various cost-effective strategies for acid rain control are discussed in comparison with the approaches taken in current congressional proposals: Aspin; Stafford; Udall-Cheny I and II; Sikorski-Waxman; Amended Stafford; and D'Amours. DOE

**N86-23071#** Institute of Oceanographic Sciences, Taunton (England).
**IMPLICATIONS OF SEDIMENTOLOGICAL AND HYDROLOGICAL PROCESSES ON THE DISTRIBUTION OF RADIONUCLIDES IN A SALT MARSH NEAR SELLAFIELD, CUMBRIA**
A. P. Carr and M. W. L. Blackley 1985 85 p refs Sponsored by UK Department of Energy
(IOS-197; DoE/RW/85/086; DGR-481/203) Avail: NTIS HC A05/MF A01

Sedimentological and hydrological processes affecting a salt marsh near a nuclear fuel reprocessing plant are discussed. The distribution of low-level radioactive effluent at the site was examined. Elevational measurements on sections across a subsidiary creek show mainly seasonal variations attributed to expansion of clay minerals. Transducers in the marsh sediment point to rapid changes in pore water pressure in response to the tidal cycle, and suggest infiltration of water and radionuclides from the coarse sediments below, especially during neap tides. Desiccation craking of the marsh clays provides preferential pathways from the surface. Results imply distribution of radionuclides by other mechanisms than simply accretion and emphasize the environmental diversity at this location. Author (ESA)

**N86-23072#** Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
**PROPOSED MECHANISMS ON THE FORMATION OF ACIDIC AEROSOLS FROM PRECURSORS**
J. L. Durham and J. R. Brock Sep. 1985 21 p Sponsored in part by Texas Univ., Austin
(PB86-100765; EPA-600/D-85-199) Avail: NTIS HC A02/MF A01 CSCL 07E

Atmospheric particles acidify through the processes of nucleation, condensation, coagulation, and gas-particle chemical reactions. The gas-phase pathway depends on the generation of free radicals that oxidize sulfur dioxide, nitrogen dioxide, and organic compounds to acids, followed by either nucleation or condensation. The aqueous-phase pathway acidification proceeds through the reactions of dissolved reductants and oxidants. The pathways for accumulation of sulfuric acid, nitric acid and organic acids in particles may differ in responses to factors such as liquid water content of the particles and mass accommodation coefficients of reactants. Laboratory chemical kinetic results indicate that photochemical gas-phase and co-absorbed oxidant reaction pathways for S(IV) may be important simultaneously, for example, in industrial-urban air during the summer. Author (GRA)

**N86-23073#** Radian Corp., Research Triangle Park, N.C.
**PRIMARY SULFATE EMISSION FACTORS FOR THE NAPAP (NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM) EMISSIONS INVENTORY Final Report, Sep. 1983 - Jul. 1985**
J. B. Homolya Sep. 1985 55 p
(Contract EPA-68-02-3994)
(PB86-108263; EPA-600/7-85-037) Avail: NTIS HC A04/MF A01 CSCL 06T

An estimation of primary sulfate emission factors for use in the 1980 and 1985 National Acid Precipitation Assessment Program (NAPAP) emissions inventories is given. The estimates were developed from an assessment of existing measurements data for source categories including external combustion, chemical manufacturing, primary metals, wood products, mineral products, and petroleum refining. Initial elements of the assessment summarized primary sulfate formation mechanisms prevalent in combustion processes and reviewed the state-of-the-art methodology for primary sulfate sampling and analysis of source emissions. The Controlled Condensation System (CCS) was evaluated as the best primary sulfate emission measurement approach. The measurement data were then used to estimate primary sulfate emission factors for the corresponding source categories. GRA

**N86-23074#** Michigan Univ., Ann Arbor.
**STATUS OF ORGANIC CONTAMINANTS IN LAKE HURON: ATMOSPHERE, WATER, ALGAE, FISH, HERRING GULL EGGS AND SEDIMENT Special Final Report**
R. G. Kreis and C. P. Rice Aug. 1985 192 p refs Sponsored in part by EPA, Chicago, Ill.
(Grant EPA-R-00551)
(PB86-127040; SR-114) Avail: NTIS HC A09/MF A01 CSCL 08H

A wide array of cntaminants has been detected in the lake basin and biota of Lake Huron. Approximately 70 contaminants have been identified to be present to date. The contaminants reported most frequently and in highest concentrations are PCBs, DDT-R, dieldrin, and mercury. Lake Huron contaminant concentrations fall within the range reported for the other Great Lakes. Within the data set, Saqinaw Bay generally contains the highest concentrations of organic compounds in water, sediment, and biota and the region that should receive the greatest amount of concern and future study. GRA

**N86-23075*#** International Bank for Reconstruction and Development, Washington, D.C.
**AQUACULTURE: A COMPONENT OF LOW COST SANITATION TECHNOLOGY**
P. Edwards 1985 66 p refs
(PB85-116431; WORLD-BANK-TP-36; ISBN-0-8213-0527-1; LC-85-6555) Avail: NTIS MF A01; HC available from World Bank, H Street, Northwest, Washington, D.C. CSCL 06C

The paper discusses all phases of aquaculture, including commercial viability, sanitary and biological considerations, public health, financial/economic and sociological aspects. Current studies are detailed and options are discussed for their potential applicability to developing countries, considering requirements for capital and labor skills as well as physical needs such as land. Author (GRA)

**N86-23076#** GCA Corp., Chapel Hill, N.C. Technology Div.
**COST AND ECONOMIC ASSESSMENT OF ALTERNATIVE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR CARBON MONOXIDE, REVISED Final Report**
M. G. Smith, S. E. Schechter, and T. McCurdy Jul. 1985 166 p Prepared in cooperation with Energy and Environmental Analysis, Inc., Arlington, Va.
(Contract EPA-68-02-3804)
(PB86-105772; EPA-450/5-85/008-Rev) Avail: NTIS HC A08/MF A01 CSCL 13B

The report presents cost and economic impact information needed to undertake a complete benefits/cost analysis of setting alternative carbon monoxide NAAQS. Four alternative 8-hour NAAQS were analyzed: 9 ppm, one observed excedance, and 9, 12, 15 ppm one expected excedance of daily maxima. The cost estimates are for both total societal and industrial sector control technology installation and operation. These include capital changes, annualized capital expenditures, and annual operating and maintenance/repair costs. Mobile source expenditures are analyzed separately from stationary source control costs. The economic impact analysis includes data on industry's ability to bear the capital expense and the inflationary and competitive impacts of incurring the control costs. Three time periods of analysis are used: 1987, 1990, and 1995. GRA

**N86-23077#** Washington State Univ., Pullman.
**OZONE BEHAVIOR IN THE COMBINED BALTIMORE-WASHINGTON, D.C. PLUME Final Report**
H. Westberg Oct. 1985 111 p
(Grant EPA-R-806683)
(PB86-120664; EPA-600/3-85-070) Avail: NTIS HC A06/MF A01 CSCL 13B

An extensive air quality monitoring program was carried out in the Washington, D.C. - Baltimore region during the July 14 - August 15 period in 1980. The field study included data collection at numerous ground stations as well as the use of two aircraft sampling platforms. Measurements included ozone, oxides of nitrogen, individual hydrocarbons (C2-C10), condensation nuclei and visual distance plus numerous meteorological parameters. Specific areas of interest in the study included the acquisition of air quality data for: (1) developing and testing a regional air quality simulation model, and (2) gaining a better understanding of oxidant production and transport in plumes emanating from Washington, D.C. and Baltimore. The purpose of the report is to describe oxidant behavior downwind of these two cities in cases where plume interaction was observed. The authors have selected seven days during the 1980 study period when southwesterly winds carried the Washington, D.C. plume into the region occupied by the Baltimore plume. GRA

**N86-22739#** Joint Publications Research Service, Arlington, Va.
**ANAEROBIC BIOLOGICAL TREATMENT OF WASTEWATER CONTAINING TNT, RDX**
Yuxiang Xue and Jainyong Jin *In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 68-77 Transl. into ENGLISH from Zhongguo Huanjing Kexue (Beijing, China), v. 5, no. 5, 21 Oct. 1985 p 2-7 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

**N86-22740#** Joint Publications Research Service, Arlington, Va.
**STUDIES OF THE PROPERTIES OF DEGRADATION OF INORGANIC CYANIDE IN THE GAS-PRODUCING WASTEWATER BY ARTIFICIAL SCREENING CYANIDE-DECOMPOSING BACTERIA STRAINS Abstract Only**
*In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 89 refs Transl. into ENGLISH from Zhongguo Huanjing Kexue (Beijing, China), v. 5, no. 5, 21 Oct. 1985 p 27-32 (For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

**N86-23018#** Joint Publications Research Service, Arlington, Va.
**SELECTION OF METHOD FOR CALCULATING SCATTERING OF IMPURITIES IN ATMOSPHERE IN STANDARDIZING RELEASE OF RADIONUCLIDES FROM HIGH SOURCES Abstract Only**
N. Ye. Artemova *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 2 Transl. into ENGLISH from Atomnaya Energiya (Moscow, USSR), v. 59, no. 3, Sept. 1985 p 216-221 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

# 46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

**N86-23078** Colorado Univ., Boulder.
**SHORT-TERM VARIABILITY OF NITROGEN DIOXIDE IN THE WINTER STRATOSPHERE Ph.D. Thesis**
Joseph Michael Zawodny 1985 157 p
Avail: Univ. Microfilms Order No. DA8522713

Measurements of limb radiance from the Solar Mesosphere Explorer satellite are used to infer the NO2 density at the 10 and 16 mB pressure levels from Jan. 9 to March 31 of 1982. A photochemical-dynamical model is developed using the accepted chemistry of the NOx family. The dynamical model produced isentropic trajectories which simulated the history of air parcels for which SME made measurements of the NO2 content. From the trajectories, the photochemical model calculated NO2 densities which were compared to those observed. The model reproduced the spatial and temporal variations well, although the long term trends of both disagreed. Further analysis indicated that the temperature sensitivity of the N2O5 photolysis cross sections could cause the disagreement in the amplitude of the short term variations. The long term/seasonal behavior of the NO2 density was found to be consistent with dynamical control of the NOx mixing ratio except at the very highest latitudes where the observed decrease in the NOx mixing ratio was large and abrupt. These rapid changes in NOx correlate well with the measured excess radiance (aerosols). A heterogeneous phase reaction of N2O5 with water aerosols to form the long lived species HNO3 may explain these trends. Dissert. Abstr.

**N86-23079** Washington Univ., Seattle.
**SPONTANEOUS EARTHQUAKE RUPTURE SIMULATED BY A FINITE ELEMENT CODE USING VARIABLE FRACTURE ENERGY ABSORPTION Ph.D. Thesis**
Hannes George Zurcher 1985 281 p
Avail: Univ. Microfilms Order No. DA8521688

A three dimensional finite element code was used to simulate rupture on a vertical strike slip fault in a half space. Vertical and lateral variations in material parameters, as well as effects of the free surface of the Earth were included. Loading conditions represented a locked section of a long strike slip fault. The fracture strength is defined by the fracture toughness which is the critical stress intensity at the crack front when unstable propagation sets in. The simulations demonstrate that although the assumed fracture criterion does not effect the final configuration of the ruptured area, it has a pronounced effect on the manner in which the rupture front develops. Propagation of a rupture front through a structured barrier has been investigated. The complex nature of the barrier can lead to the establishment of a potential aftershock area of the size of the barrier, in that a strong section can protect a comparatively less strong section from rupturing by a type of shadow effect. Dissert. Abstr.

**N86-23080** North Carolina State Univ., Raleigh.
**INTERPRETATION OF ELECTROMAGNETIC DIPOLE-DIPOLE FREQUENCY SOUNDING DATA OVER A VERTICALLY STRATIFIED EARTH Ph.D. Thesis**
Kang-Hyee Son 1985 161 p
Avail: Univ. Microfilms Order No. DA8518283

An inversion method has been developed to interpret electromagnetic (EM) frequency sounding data in terms of a multilayer conductivity model. The amount of computation, and the numerical difficulty (overparameterization) of the inversion inherent in the nonlinear least-squares method, are reduced by combining Marquardt's least-squares technique and the generalized inverse method. The inversion procedure is illustrated through the use of synthetic data based on multilayered earth models. When the method is applied to field data, the solutions are general agreement with information obtained from drilling. Uncertainty in the sensor altitude is resolved through the inversion process using high-frequency data for which the ocean may be considered as an infinite half-space. The effect of variation of the coil axis with respect to the sea surface can be resolved if the inclination is measured and incorporated into the inversion process.
Dissert. Abstr.

**N86-23081** Kentucky Univ., Lexington.
**DIRECT BOUNDARY INTEGRAL EQUATION METHODS FOR A CLASS OF EARTH-STRUCTURE INTERACTION PROBLEMS Ph.D. Thesis**
Mohsen Rezayat 1985 219 p
Avail: Univ. Microfilms Order No. DA8523930

Direct vector Boundary Integral Equation (BIE) formulations and numerical solution procedures are presented for problems of

three-dimensional wave radiation and scattering from arbitrary shaped obstacles. The radiation and scattering may occur in a homogeneous elastic full-space or a viscoelastic layered half-space. Initially, time is removed from the formulation as an independent variable by assuming that the field variables vary in a simple harmonic manner with time. Displacement and traction on an object surface are the primary variables, rather than wave potentials, and the integral formulas which are the basis for numerical computations are given in a form entirely free of integrals of the Cauchy Principle Value type. Indeed, signularities associated with the kernels are removed analytically before numerical quadrature is attempted. All integrations, all modeling for numerical purposes and the very description and solution of a problem are confined strictly to the surface of the obstacle. The soundness of the mathematical formulation and the integrity of the numerical procedures is established by comparing the results obtained by this method with other solutions when available. Dissert. Abstr.

**N86-23082** Ohio State Univ., Columbus.
**RECOVERY OF 1 DEG-MEAN ANOMALIES IN A LOCAL REGION FROM A LOW-LOW SATELLITE TO SATELLITE TRACKING MISSION Ph.D. Thesis**
Chugiat Wichiencharoen 1985 138 p
Avail: Univ. Microfilms Order No. DA8526274

The accuracy of 1 degree-mean anomalies which could be recovered from the Geopotential Research Mission (GRM) data was simulated. The Earth's gravity field was defined by a set of potential coefficients of Rapp (1981) to degree 180. Line of sight accelerations were used as measurements in the recovery. The line of sight acceleration can be expressed in terms of potential coefficients, which makes data generation at a regular grid interval very efficient. An altitude of 160 kilometers above a spherical Earth and a separation of 200 kilometers were used in the data simulation. Three methods were used in the recovery: the least squares collocation method; a numerical integration procedure proposed by Rummel (1982) or the Rummel procedure; and the least squares adjustment. The results of the least squares collocation and the least squares adjustment indicated that an accuracy of 2.5 milligals for 1 the degree -mean anomalies was possible in an area of the smooth gravity field. The accuracy of the recovery over the rough gravity field was about 30 milligals. Dissert. Abstr.

**N86-23083** Ohio State Univ., Columbus.
**DISTURBANCE VECTOR IN SPACE FROM SURFACE GRAVITY ANOMALIES USING COMPLEMENTARY MODELS Ph.D. Thesis**
Jaime Yap Cruz 1985 155 p
Avail: Univ. Microfilms Order No. DA8526164

This modeling of the external disturbance vector of the Earth from surface gravity anomaly data is discussed. The low frequency features of the signal are represented in spherical harmonic series. The recovery of the coefficients of the series from the given gravity anomalies is discussed focusing on the use of analytical continuation and ellipsoidal corrections to account for the Earth's topography and ellipticity. The spectrum and data response of the spatial disturbance vector are studied to aid the design of models and experiments. The local models studied to complement the globally valid spherical harmonic model are: (1) the residual topographic model (RTM), (2) the classical integral model, (3) three versions of the Dirac approach to collocation, and finally (4) two versions of the least squares collocation approach. Dissert. Abstr.

**N86-23084** California Univ., Berkeley.
**ESTIMATION OF SEISMIC WAVE COHERENCY AND RUPTURE VELOCITY USING THE SMART 1 STRONG MOTION ARRAY RECORDINGS Ph.D. Thesis**
Norman Alan Abrahamson 1985 135 p
Avail: Univ. Microfilms Order No. DA8524872

The January 29, 1981 Taiwan earthquake (M sub L = 6.7) was recorded digitally by 27 triaxial force-balanced accelerometers in the SMART 1 strong motion array centered 30 km north-northwest of the epicenter. The seismic source of this event had a reverse mechanism with unilateral rupture from east to west. These array recordings are used to make direct measurements of the wave coherency and the time dependent rupture velocity. Frequency-wavenumber analysis shows that across the 4 km array, the P waves contain coherent energy from the source region at frequencies up to 6 Hz while the S waves contain coherent energy up to 3 Hz. Significant energy is present in the P and S waves at frequencies above these two levels, but it is incoherent or scattered energy. Some refinements of the traditional wavenumber spectra analysis for array measurements are developed. The time dependent rupture velocity is estimated by measuring the time dependent phasing of the coherent P and S waves across the array. This estimate is believed to be the first obtained with a 2-dimensional strong motion array. Dissert. Abstr.

**N86-23085** California Univ., Los Angeles.
**DEFORMATION OF THE SAN ANDREAS FAULT SYSTEM INFERRED FROM TRILATERATION MEASUREMENTS Ph.D. Thesis**
Ching-Chau Abe Cheng 1985 386 p
Avail: Univ. Microfilms Order No. DA8525840

The San Andreas fault system is responsible for most of the deformation on the boundary between the North American and Pacific plates. The fault system was studied from the San Francisco Bay south to the Salton Trough because it is well covered by the USGS trilateration networks which have been measured almost every year or two since 1970. The measurements were examined to determine whether any systematic errors contribute a long term variation and how such errors influence estimates of secular fault deformation. Then, with Matsu'ura's fault model and given geological observations, trilateration measurements were used to calculate fault parameters. From San Francisco to Stalton Sea, the San Andreas fault system is divided into four regions. Cumulative fault displacements are high at Hollister/Bear Valley and Cajon Pass/Salton Sea, but low in the San Francisco Bay and in the Transverse Ranges. Shallow faultings from trilateration data match most surface displacements of locked and creeping faults. Dissert. Abstr.

**N86-23086** California Univ., Berkeley.
**GEOPHYSICAL EXPLORATION WITH AUDIO FREQUENCY MAGNETIC FIELDS Ph.D. Thesis**
Victor Franklin Labson 1985 140 p
Avail: Univ. Microfilms Order No. DA8525022

Experience with the Audio Frequency Magnetic (AFMAG) method has demonstrated that an electromagnetic exploration system using the Earth's natural audiofrequency magnetic fields as an energy source, is capable of mapping subsurface electrical structure in the upper kilometer of the Earth's crust. The limitations are resolved by adapting the tensor analysis and remote reference noise bias removal techniques from the geomagnetic induction and magnetotelluric methods to the computation of the tippers. After a through spectral study of the natural magnetic fields, lightweight magnetic field sensors, capable of measuring the magnetic field throughout the year were designed. A digital acquisition and processing sytem, with the ability to provide audiofrequency tipper results in the field, was then built to complete the apparatus. The new instrumetnation was used in a study of the Mariposa, California site previously mapped with AFMAG. The usefulness of natural magnetic field data in mapping an electrical conductive body was again demonstrated. Several field examples are used to demonstrate that the proposed procedure yields reasonable results. Dissert. Abstr.

**N86-23087** Uppsala Ionospheric Observatory (Sweden).
**LOWER HYBRID PARAMETRIC PROCESSES IN THE IONOSPHERE AND MAGNETOSPHERE: THEORY AND APPLICATIONS Ph.D. Thesis - Uppsala Univ., Sweden**
Hannu E. Koskinen 1985 84 p refs
(UIO-SR-85-04; ISSN-0349-2699) Copyright. Avail: Issuing Activity

The theory of parametric processes of lower hybrid waves in multispecies plasmas is applied to space plasma physics. Resonant

decay processes and processes involving nonresonant quasi-modes are considered. The parametric dispersion equation is derived in the dipole approximation and different channels of parametric processes are compared with each other using a model of magnetospheric plasma at an altitude of 2500 km along the auroral field lines. The validity and consequences of the dipole approximation and the effects of inhomogeneities in the background magnetic field and in plasma density are discussed. It is shown that the parametric processes can be active in a mechanism of energy transfer from precipitating auroral electrons. The theory is also applied to ionospheric sounding rocket experiments where lower hybrid waves were detected. Author (ESA)

**N86-23088*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SAGE AEROSOL MEASUREMENTS. VOLUME 2: 1 JANUARY - 31 DECEMBER 1980**
M. Patrick McCormick Jan. 1986 310 p refs 2 Vol.
(NASA-RP-1149; L-16028; NAS 1.61:1149) Avail: NTIS HC A14/MF A01 CSCL 04A

The stratospheric Aerosol and Gas Experiment (SAGE) satellite system, launched on February 18, 1979, provides profiles of aerosol extinction at wavelengths of 1.00 and 0.45 micron, ozone concentration, and nitrogen dioxide concentration. Data taken during sunset events in the form of zonal averages and seasonal averages of the aerosol extinction at 1.00 and 0.45 micron, ratios of the aerosol extinction to the molecular extinction at 1.00 micron, and ratios of the aerosol extinction at 0.45 micron to the aerosol extinction at 1.00 micron are presented. The averages for 1980 are shown in tables and in profile and contour plots (as a function of altitude and latitude). In addition, temperature data provided by the National Oceanic and Atmospheric Administration (NOAA) for the time and location of each SAGE measurement are averaged and shown in a similar format. Author

**N86-23089*#** Lunar and Planetary Inst., Houston, Tex.
**WORKSHOP ON THE TECTONIC EVOLUTION OF GREENSTONE BELTS**
1986 143 p refs Workshop held in Houston, Tex., 16-18 Jan. 1986
(Contract NASw-4066)
(NASA-CR-176619; NAS 1.26:176619; LPI-Contrib-584) Avail: NTIS HC A07/MF A01 CSCL 08G

The Workshop on the Tectonic Evolution of Greenstone Belts, which is part of the Universities Space Research Association, Lunar and Planetary Institute, of Houston, Texas, met there on Jan. 16-18, 1986. A number of plate tectonic hypotheses have been proposed to explain the origin of Archean and Phanerozoic greenstone/ophiolite terranes. These hypotheses are explored in the abstracts. For individual titles, see N86-23090 through N86-23137.

**N86-23090*#** Oregon State Univ., Corvallis. College of Oceanography.
**HOT SPOT ABUNDANCE, RIDGE SUBDUCTION AND THE EVOLUTION OF GREENSTONE BELTS**
Dallas Abbott and Sarah Hoffman *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 1-3 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

A number of plate tectonic hypotheses have been proposed to explain the origin of Archaean and Phanerozoic greenstone/ophiolite terranes. In these models, ophiolites or greenstone belts represent the remnants of one or more of the following: island arcs, rifted continental margins, oceanic crustal sections, and hot spot volcanic products. If plate tectonics has been active since the creation of the Earth, it is logical to suppose that the same types of tectonic processes which form present day ophiolites also formed Archaean greenstone belts. However, the relative importance of the various tectonic processes may well have been different and are discussed. Author

**N86-23091*#** Hope College, Holland, Mich. Dept. of Geology.
**LITHOLOGY, AGE AND STRUCTURE OF EARLY PROTEROZOIC GREENSTONE BELTS, WEST AFRICAN SHIELD**
Kodjo Attoh *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 4-6 (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

Lithologic and chemical data have been compiled for belts in the Proterozoic terrane. Available stratigraphic information from geologic maps of these areas indicate that a typical sequence is comprised of predominately mafic lava flows (basalt-andesite) at the base, which are overlain by felsic volcanic rocks including pyroclastic rocks and lavas. Lithostratigraphic data indicate the volcanic succession is 6-8 km thick. This is followed by 3-4 km of basaltic lava flows which are locally pillowed, the top of the unit is marked by a distinctive manganese formation (MF) consisting of Mn-Fe rich cherts up to 200 m thick. The youngest volcanic unit consists of mafic tuffs and breccia with a distinctive fragmental texture. Of about 100 chemical analyses reported calc-alkaline rocks constitute 55% and tholeiites 45%. Quartz-normative basalt constitutes 99% of the rock type in the tholeiitic suite. In the calc-alkaline suite, 9% of the analyses is basalt, 45% andesite and the rest is dacite and rhyodacite. The available data lead to the conclusion that the minimum age for the volcanic activity must be between 2200 and 2100 million years. It is significant that Archean ages have not been reported from any of the volcanic belts (1-10). F.M.R.

**N86-23092*#** Missouri Univ., Columbia. Dept. of Geology.
**CORRELATIONS AND CONTRASTS IN STRUCTURAL HISTORY AND STYLE BETWEEN AN ARCHAEAN GREENSTONE BELT AND ADJACENT GNEISS BELT, NE MINNESOTA**
R. L. Bauer, P. J. Hudleston (Minnesota Univ., Minneapolis), and D. L. Southwick (Minnesota Geological Survey, St. Paul) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 7-8 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

An analysis of the deformation along the boundary between the Vermilion Granitic Complex (VGC) and the Vermilion district indicates that the two terranes have seen a similar deformation history since the earliest stages of folding in the area. Despite this common history, variations in structural style occur between the two terranes, such as the relative development of D sub 1 fabrics and D sub 2 shear zones, and these can be attributed to differences in the crustal levels of the two terranes during the deformation. Similarly, the local development of F sub 3 folds in the VGC, but not in the Vermilion district, is interpreted to be a result of later-D sub 2 pluton emplacement which was not significant at the level of exposure of ther Vermilion district. Author

**N86-23093*#** National Geophysical Research Inst., Hyderabad (India).
**TECTONIC EVOLUTION OF GREENSTONE-GNEISS ASSOCIATION IN DHARWAR CRATON, SOUTH INDIA: PROBLEMS AND PERSPECTIVES FOR FUTURE RESEARCH**
Y. J. Bhaskar Rao *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 9-10 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The two fold stratigraphic subdivision of the Archean-Proterozoic greenstone-gneiss association of Dharwar craton into an older Sargur group (older than 2.9 Ga.) and a younger Dharwar Supergroup serves as an a priori stratigraphic model. The concordant greenstone (schist)-gneiss (Peninsular gneiss) relationships, ambiguities in stratigraphic correlations of the schist belts assigned to Sargur group and difficulties in deciphering the older gneiss units can be best appreciated if the Sargur group be regarded as a trimodal association of: (1) ultrabasic-mafic metavolcanics (including komatiites), (2) clastic and nonclastic metasediments and paragneisses and (3) mainly tonalite/trondhemite gneisses and migmatites of diverse ages which could be as old as c. 3.4 ga. or even older. The extensive occurrence of this

greenstone-gneiss complex is evident from recent mapping in many areas of central and southern Karnataka State. Author

**N86-23094*#** Houston Univ., Tex. Dept. of Geosciences.
**CAN TRACT ELEMENT DISTRIBUTIONS RECLAIM TECTONO-MAGMATIC FACIES OF BASALTS IN GREENSTONE ASSEMBLAGES?**
J. C. Butler *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 11-13 refs (For primary document see N86-23089 13-46)
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During the past two decades many words have been written both for and against the hypothesis that the tectonic setting of a suite of igneous rocks is retained by the chemical variability within the suite. For example, it is argued that diagrams can be constructed from modern/recent basalt subcompositions within the system Ti-Zr-Y-Nb-Sr such that tectonomagmatic settings can be reclaimed. If one accepts this conclusion, it is tempting to inquire as to how far this hypothesis can be extended into other petrological realms. If chemical variations of metabasalts retain information relating to their genesis (tectonic setting), for example, this would be most helpful in reconstructing the history of basalts from greenstone belts. A discussion follows. Author

**N86-23095*#** Louisiana State Univ., Baton Rouge. Dept. of Geology.
**BARBERTON GREENSTONE BELT VOLCANISM: SUCCESSION, STYLE AND PETROGENESIS**
Gary R. Byerly and Donald R. Lowe *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 14-16 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The Barberton Mountain Land is an early Archean greenstone belt along the eastern margin of the Kaapvaal Craton of southern Africa. Detailed mapping in the southern portion of the belt leads to the conclusion that a substantial thickness is due to original deposition of volcanics and sediments. In the area mapped, a minimum thickness of 12km of predominantly mafic and ultramafic volcanics comprise the Komati, Hooggenoeg, and Kromberg Formations of the Onverwacht Group, and at least one km of predominantly pyroclastic and epiclastic sediments derived from dacitic volcanics comprise the Fig Tree Group. The Barberton greenstone belt formed primarily by ultramafic to mafic volcanism on a shallow marine platform which underwent little or no concurrent extension. Vents for this igneous activity were probably of the non-constructional fissure type. Dacitic volcanism occurred throughout the sequence in minor amounts. Large, constructional vent complexes were formed, and explosive eruptions widely dispersed pyroclastic debris. Only in the final stages of evolution of the belt did significant thrust-faulting occur, generally after, though perhaps overlapping with, the final stage of dacitic igneous activity. A discussion follows. Author

**N86-23096*#** Geological Survey of Canada, Ottawa (Ontario).
**TECTONIC SETTING AND EVOLUTION OF LATE ARCHAEAN GREENSTONE BELTS OF SUPERIOR PROVINCE, CANADA**
K. D. Card *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 17-19 refs (For primary document see N86-23089 13-46)
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Late Archean (3.0-2.5 Ga) greenstone belts are a major component of the Superior Province of the Canadian Shield where alternating, metavolcanic - rich and metasedimentary - rich subprovinces form a prominent central striped region bordered in part by high-grade gneiss subprovinces, the Pikiwitonei and Minto in the north, and the Minnesota River Valley in the south. The high-grade gneiss subprovinces are characterized by granulite facies gneiss of plutonic and supracrustal origin, and by abundant plutonic rocks. Minnesota River Valley has rocks older than 3.5 Ga; absolute ages of Pikiwitonei and Minto rocks are unknown but Minto does have north-south structural trends distinctive from the dominant east-west structures of Superior Province. A discussion follows. Author

**N86-23097*#** Royal Ontario Museum, Toronto. Geochronology Lab.
**HIGH PRECISION U-PB GEOCHRONOLOGY AND IMPLICATIONS FOR THE TECTONIC EVOLUTION OF THE SUPERIOR PROVINCE**
D. W. Davis, F. Corfu, and T. E. Krogh *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 20-22 refs (For primary document see N86-23089 13-46)
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The underlying mechanisms of Archean tectonics and the degree to which modern plate tectonic models are applicable early in Earth's history continue to be a subject of considerable debate. A precise knowledge of the timing of geological events is of the utmost importance in studying this problem. The high precision U-Pb method has been applied in recent years to rock units in many areas of the Superior Province. Most of these data have precisions of about + or - 2-3 Ma. The resulting detailed chronologies of local igneous development and the regional age relationships furnish tight constraints on any Archean tectonic model. Superior province terrains can be classified into 3 types: (1) low grade areas dominated by meta-volcanic rocks (greenstone belts); (2) high grade, largely metaplutonic areas with abundant orthogneiss and foliated to massive I-type granitoid bodies; and (3) high grade areas with abundant metasediments, paragneiss and S-type plutons. Most of the U-Pb age determinations have been done on type 1 terrains with very few having been done in type 3 terrains. A compilation of over 120 ages indicates that the major part of igneous activity took place in the period 2760-2670 Ma, known as the Kenoran event. This event was ubiquitous throughout the Superior Province. Author

**N86-23098*#** National Physical Research Lab., Pretoria (South Africa).
**CRUSTAL STRUCTURE OF THE ARCHAEAN GRANITE-GREENSTONE TERRANE IN THE NORTHERN PORTION OF THE KAAPVAAL CRATON**
J. H. deBeer, E. H. Stettler (Geological Survey, Pretoria, South Africa), J. M. Barton, Jr. (Rand Afrikaans Univ., Johannesburg, South Africa), D. D. vanReenen (Rand Afrikaans Univ., Johannesburg, South Africa), and J. R. Bearncombe (Rand Afrikaans Univ., Johannesburg, South Africa) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 23-24 (For primary document see N86-23089 13-46)
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Recent investigations of the electrical resistivity, gravity and aeromagnetic signatures of the various granite-greenstone units in the northern portion of the Kaapvaal craton have revealed three features of significance: (1) the Archean greenstone belts are shallow features, rarely exceeding 5 km in depth; (2) the high resistivity upper crustal layer typical of the lower grade granite-greenstone terranes is absent in the granulite facies terrane; and (3) the aeromagnetic lineation patterns allow the granite-greenstone terrane to be subdivided into geologically recognizable tectono-metamorphic domains on the basis of lineation frequency and direction. A discussion follows. Author

**N86-23099*#** Lunar and Planetary Inst., Houston, Tex.
**EXTENSIONAL TECTONICS DURING THE IGNEOUS EMPLACEMENT OF THE MAFIC-ULTRAMAFIC ROCKS OF THE BARBERTON GREENSTONE BELT**
M. J. deWit *In its* Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 25-26 refs (For primary document see N86-23089 13-46)
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The simatic rocks (Onverwacht Group) of the Barberton greenstone belt are part of the Jamestown ophiolite complex. This ophiolite, together with its thick sedimentary cover occupies a complex thrust belt. Field studies have identified two types of early faults which are entirely confined to the simatic rocks and are deformed by the later thrusts and associated folds. The first type of fault (F1a) is regional and always occurs in the simatic rocks along and parallel to the lower contacts of the ophiolite-related cherts (Middle Marker and equivalent layers). These fault

zones have previously been referred to both as flaser-banded gneisses and as weathering horizons. In general the zones range between 1-30m in thickness. Displacements along these zones are difficult to estimate, but may be in the order of 1-100 km. The structures indicate that the faults formed close to horizontal, during extensional shear and were therefore low angle normal faults. F1a zones overlap in age with the formation of the ophiolite complex. The second type of faults (F1b) are vertical brittle-ductile shear zones, which crosscut the complex at variable angles and cannot always be traced from plutonic to overlying extrusive (pillowed) simatic rocks. F1b zones are also apparently of penecontemporaneous origin with the intrusive-extrusive igneous processs. F1b zones may either represent transform fault-type activity or represent root zones (steepened extensions) of F1a zones. Both fault types indicate extensive deformation in the rocks of the greenstone belt prior to compressional overthrust tectonics. F.M.R.

**N86-23100*#** Lunar and Planetary Inst., Houston, Tex.
**A MID-ARCHAEAN OPHIOLITE COMPLEX, BARBERTON MOUNTAIN LAND**
M. J. dewit, Roger Hart (Oregon State Univ., Corvallis), and Rodger Hart (Witwatersrand Univ., Johannesburg, South Africa) *In its* Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 27-32 refs (For primary document see N86-23089 13-46)
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New field observations and structurally restored geologic sections through the southern part of 3.5-3.6 Ga Barberton greenstone belt show that its mafic to ultramafic rocks form a pseudostratigraphy comparable to that of Phanerozoic ophiolites; this ancient ophiolite is referred to as the Jamestown ophiolite complex. It consists of an intrusive-extrusive mafic-ultramafic section, underlain by a high-temperature tectono-metamorphic residual peridotitic base, and is capped by a chert-shale sequence which it locally intrudes. Geochemical data support an ophiolitic comparison. Fraction of high temperature melting PGE's > 2500 C in the residual rocks suggest a lower mantle origin for the precursors of this crust. An oceanic rather than arc-related crustal section can be inferred from the absence of contemporaneous andesites. The entire simatic section has also been chemically altered during its formation by hyrothermal interaction with the Archean hydrosphere. The most primitive parent liquids, from which the extrusive sequence evolved, may have been picritic in character. Rocks with a komatiitic chemistry may have been derived during crystal accumulation from picrite-crystal mushes (predominantly olivine-clinopyroxene) and/or by metasomatism during one or more subsequent episodes of hydration-dehydration. The Jamestown ophiolite complex provides the oldest record with evidence for the formation of oceanic lithosphere at constructive tectonic boundaries. F.M.R.

**N86-23101*#** Energy, Mines and Resources Canada, Ottawa (Ontario). Earth Physics Branch.
**HEAT FLOW AND HEAT GENERATION IN GREENSTONE BELTS**
Malcolm J. Drury *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 33-35 refs (For primary document see N86-23089 13-46)
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Heat flow has been measured in Precambrian shields in both greenstone belts and crystalline terrains. Values are generally low, reflecting the great age and tectonic stability of the shields; they range typically between 30 and 50 mW/sq m, although extreme values of 18 and 79 mW/sq m have been reported. For large areas of the Earth's surface that are assumed to have been subjected to a common thermotectonic event, plots of heat flow against heat generation appear to be linear, although there may be considerable scatter in the data. The relationship is expressed as: Q = Q sub o + D A sub o in which Q is the observed heat flow, A sub o is the measured heat generation at the surface, Q sub o is the reduced heat flow from the lower crust and mantle, and D, which has the dimension of length, represents a scale depth for the distribution of radiogenic elements. Most authors have not used data from greenstone belts in attempting to define the relationship within shields, considering them unrepresentative and preferring to use data from relatively homogeneous crystalline rocks. A discussion follows. Author

**N86-23102*#** Lunar and Planetary Inst., Houston, Tex.
**KOMATIITE GENESIS IN THE ARCHAEAN MANTLE, WITH IMPLICATIONS FOR THE TECTONICS OF ARCHAEAN GREENSTONE BELTS**
D. Elthon *In its* Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 36-38 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The presence of ultramafic lavas (komatiites) associated with Archean greenstone belts has been suggested to indicate very high increments (50-80%) of partial melting of the Archean mantle. Such extensive melting of the Earth's mantle during the Archean might have profound effects on the early tectonic and chemical evolution of the planet, although problems associated with keeping the komatiite liquid in equilibrium with the residual mantle at such high increments of melting has cast doubt upon aspects of extensive melting. Two important aspects of the origin of komatiites are discussed below. Author

**N86-23103*#** Western Australian Inst. of Tech., Bentley.
**THE YILGARN CRATON WESTERN AUSTRALIA: A TECTONIC SYNTHESIS**
R. E. P. Fripp *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 39-40 refs (For primary document see N86-23089 13-46)
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The Yilgarn Craton in Western Australia is one of the larger contiguous preserved Archaean crustal fragments, with an area of about 650,000 square kilometres. Of this, by area, about 70% is granitoid and 30% greenstone. The Craton is defined by the Darling Fault on its western margin, by Proterozoic deformation belts on its southern and northwestern margins, and by unconformable younger sediments on its eastern and northeastern margins. A regional geotectonic synthesis at a scale of 1:500,000 is being prepared. This is based largely upon the 1:250,000 scale mapping of the Geological Survey of Western Australia together with interpretation using geophysical data, mainly airborne magnetic surveys. On a regional basis the granitoids are classied as pre-, syn- and post-tectonic with respect to greenstone belt deformation. The post-tectonic granitoids yield Rb-Sr isochrons of about 2.6 b.y., close to Rb-Sr ages for the greenstones themselves which are up to about 2.8 b.y. old, although data for the latter is sparse. Contacts between earlier granitoids and greenstones which are not obscured by the post-tectonic granitoids are most commonly tectonic contacts, intensely deformed and with mylonitic fabrics. The general concensus however is that there is a pre-tectonic, pre-greenhouse sialic gneiss preserved in places. A discussion follows. Author

**N86-23104*#** Cornell Univ., Ithaca, N.Y. Institute for the Study of the Continents.
**TECTONICS OF SOME AMAZONIAN GREENSTONE BELTS**
Allan K. Gibbs *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 41-43 refs Sponsored in part by the Guyana Geological Survey and Utah International, Ltd. (For primary document see N86-23089 13-46)
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Greenstone belts exposed amid gneisses, granitoid rocks, and less abundant granulites along the northern and eastern margins of the Amazonian Craton yield Trans-Amazonican metamorphic ages of 2.0-2.1 Ga. Early proterozoic belts in the northern region probably originated as ensimatic island arc complexes. The Archean Carajas belt in the southeastern craton probably formed in an extensional basin on older continental basement. That basement contains older Archean belts with pillow basalts and komatiites.

Belts of ultramafic rocks warrant investigatijon as possible ophiolites. A discussion follows. Author

**N86-23105*#** Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Div. of Petrology and Geochemistry.

**SPATIAL GREENSTONE-GNEISS RELATIONSHIPS: EVIDENCE FROM MAFIC-ULTRAMAFIC XENOLITH DISTRIBUTION PATTERNS**

A. Y. Glikson *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 44-46 (For primary document see N86-23089 13-46)

Avail: NTIS HC A07/MF A01 CSCL 08G

The distribution patterns of mafic-ultramafic xenoliths within Archaean orthogneiss terrain furnish an essential key for the elucidation of granite-greenstone relations. Most greenstone belts constitute mega-xenoliths rather than primary basin structures. Transition along strike and across strike between stratigraphically low greenstone sequences and xenolith chains demonstrate their contemporaneity. These terrains represent least deformed cratonic islands within an otherwise penetratively foliated deformed gneiss-greenstone crust. Whereas early greenstone sequences are invariably intruded by tonalitic/trondhjemitic/granodioritic gneisses, stratigraphically higher successions may locally overlap older gneiss terrains and their entrained xenoliths unconformably. The contiguity of xenolith patterns suggests their derivation as relics of regional mafic-ultramafic volcanic crustal units and places limits on horizontal movements between individual crustal blocks. F.M.R.

**N86-23106*#** State Univ. of New York, Albany. Dept. of Geological Sciences.

**DISMEMBERED ARCHAEAN OPHIOLITE IN THE SOUTHEASTERN WIND RIVER MOUNTAINS, WYOMING: REMAINS OF ARCHAEAN OCEANIC CRUST**

G. D. Harper *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 47-49 refs (For primary document see N86-23089 13-46)

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Archean mafic and ultramafic rocks occur in the southeastern Wind River Mountains near Atlantic City, Wyoming and are interpreted to represent a dismembered ophiolite suite. The ophiolitic rocks occur in a thin belt intruded by the 2.6 Ga Louis Lake Batholith on the northwest. On the southeast they are in fault contact with the Miners Delight Formation comprised primarily of metagraywackes with minor calc-alkaline volcanics. The ophiolitic and associated metasedimentry rocks (Goldman Meadows Formation) have been multiply deformed and metamorphosed. The most prominant structures are a pronounced steeply plunging stretching lineation and steeply dipping foliation. These structural data indicate that the ophiolitic and associated metasedimentary rocks have been deformed by simple shear. The ophiolitic rocks are interpreted as the remains of Archean oceanic crust, probably formed at either a mid-ocean ridge or back-arc basin. All the units of a complete ophiolite are present except for upper mantle periodotities. The absence of upper mantle rocks may be the result of detactment within the crust, rather than within the upper mantle, during emplacement. This could have been the result of a steeper geothermal gradient in the Archean oceanic lithosphere, or may have resulted from a thicker oceanic crust in the Archean. F.M.R.

**N86-23107*#** Geological Survey, Laramie, Wyo.

**PRELIMINARY REPORT ON THE GEOLOGY AND GOLD MINERALIZATION OF THE SOUTH PASS GRANITE-GREENSTONE TERRAIN, WIND RIVER MOUNTAINS, WESTERN WYOMING (US)**

W. D. Hausel *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 50-51 refs (For primary document see N86-23089 13-46)

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The South Pass granite-greenstone terrain lies near the southern tip of the Wind River Mountains of western Wyoming. This Archean supracrustal pile has been Wyoming's most prolific source of gold and iron ore. From 1962 to 1983, more than 90 million tons of iron ore were recovered from oxide-facies banded iron formation, and an estimated 325,000 ounces of gold were mined from metagreywacke-hosted shears and associated placers. Precambrian rocks at South Pass are unconformably overlain by Paleozoic sediments along the northeast flank, and a Tertiary pediment buries Archean supracrustals on the west and south. To the northwest, the supracrustals terminate against granodiorite of the Louis Lake batholith; to the east, the supracrustals terminate against granite of the Granite Mountains batholith. The Louis Lake granodiorite is approximately 2,630 + or - 20 m.y. old, and the Granite Mountains granite averages 2,600 m.y. old. The geometry of the greenstone belt is best expressed as a synform that has been modified by complex faulting and folding. Metamorphism is amphibolite grade surrounding a small island of greenschist facies rocks. The younger of the Archean supracrustal successions is the Miners Delight Formation. This unit yielded a Rb-Sr isochron of 2,800 m.y. A sample of galena from the Snowbird Mine within the Miners Delight Formation yielded a model age averaging 2,750 m.y. The Snowbird mineralization appears to be syngenetic and is hosted by metavolcanics of calc-alkaline affinity. Discussion follows. Author

**N86-23108*#** State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.

**THE KOLAR SCHIST BELT: A POSSIBLE ARCHAEAN SUTURE ZONE**

G. N. Hanson, E. J. Krogstad, V. Ragamani (Jawaharlal Nehru Univ., New Delhi, India), and S. Balakrishnan (Jawaharlal Nehru Univ., New Delhi, India) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 52-54 refs (For primary document see N86-23089 13-46)

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The Kolar Schist Belt represents a N-S trending discontinuity in the structures, lithologies, and emplacement and metamorphic ages of late Archean gneisses. The suggestion of a much older basement on the west side of the belt is not seen on the east. Within the schist belt amphibolites from each side have distinctly different chemical characteristics, suggesting different sources at similar mantle depths. These amphibolites were probably not part of a single volcanic sequence, but may have formed about the same time in two completely different settings. Could the amphibolites with depleted light REE patterns represent Archean ocean floor volcanics which are derived from a mantle source with a long term depletion of the light REE? Why are the amphibolites giving an age which may be older than the exposed gneisses immediately on either side of the belt? These results suggest that it is necessary to seriously consider whether the Kolar Schist Belt may be a suture between two late Archean continental terranes. Author

**N86-23109*#** Queens Univ., Kingston (Ontario). Dept. of Geological Sciences.

**EVIDENCE FOR SPREADING IN THE LOWER KAM GROUP OF THE YELLOWKNIFE GREENSTONE BELT: IMPLICATIONS FOR ARCHAEAN BASIN EVOLUTION IN THE SLAVE PROVINCE**

H. Helmstaedt and W. A. Padgham *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 55-58 refs (For primary document see N86-23089 13-46)

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The Yellowknife greenstone belt is the western margin of an Archean turbidite-filled basin bordered on the east by the Cameron River and Beaulieu River volcanic belts (Henderson, 1981; Lambert, 1982). This model implies that rifting was entirely ensialic and did not proceed beyond the graben stage. Volcanism is assumed to have been restricted to the boundary faults, and the basin was floored by a downfaulted granitic basement. On the other hand, the enormous thickness of submarine volcanic rocks and the presence of a spreading complex at the base of the Kam Group suggest that volcanic rocks were much more widespread than indicated by their present distribution. Rather than resembling volcanic sequences in intracratonic graben structures, the Kam Group and its tectonic setting within the Yellowknife greenstone

belt have greater affinities to the Rocas Verdes of southern Chile, Mesozoic ophiolites, that were formed in an arc-related marginal basin setting. The similarities of these ophiolites with some Archean volcanic sequences was previously recognized, and served as basis for their marginal-basin model of greenstone belts. The discovery of a multiple and sheeted dike complex in the Kam Group confirms that features typical of Phanerozoic ophiolites are indeed preserved in some greenstone belts and provides further field evidence in support of such a model. Author

**N86-23110*#** Montreal Univ. (Quebec). Dept. of Geology.
**ARCHAEAN WRENCH-FAULT TECTONICS IN THE ABITIBI GREENSTONE BELT OF CANADA**
C.202Ludden Hubert, J. N. *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 59-61 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

A tectonic model is proposed in which the southern Abitibi belt formed in a series of rift basins which dissected an earlier formed volcanic arc. Comparisons can be made with Phanerozoic areas such as, the Hokuroko basin of Japan, the Taupo volcanic zone of new Zealand and the Sumatra and Nicaragua volcanic arcs. In addition the identification of the major E - W thrust shears make it possible to speculate that the southern Abitibi belt comprises a collage of blocks of terrane which have been accreted against a more stable continental margin or microcontinent. If this interpretation is correct analogies can be made with the SW margin of the U.S.A. in which recently formed blocks of volcanic terrane are being accreted against its western margin. Author

**N86-23111*#** Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
**TRANSPRESSION AS THE MAIN DEFORMATIONAL EVENT IN AN ARCHAEAN GREENSTONE BELT, NORTHEASTERN MINNESOTA**
P. J. Hudleston, D. Schultz-Ela, R. L. Bauer (Missouri Univ., Columbia), and D. L. Southwick (Minnesota Geological Survey, St. Paul) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 62-63 refs (For primary document see N86-23089 13-46)
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Deformed and metamorphosed sedimentary and volcanic rocks of the Vermilion district constitute an Archean greenstone belt trending east-west between higher grade rocks of the Vermilion Granitic Complex to the north and the Giants Range batholith to the south. Metamorphic grade is low throughout, being lowest in the center of the belt (chlorite zone of the greenschist facies). All the measured strain, a cleavage or schistosity, and a mineral lineation in this belt are attributed to the main phase of deformation D sub 2 that followed an earlier nappe-forming event D sub 1, which left little evidence of penetrative fabric. Previous work assumed that the D sub 2 deformation resulted from north-south compression across the district. It is now believed that a significant component of this deformation resulted from dextral shear across the whole region. Thus the Vermilion fault, a late-state largely strike-slip structure that bounds the Vermilion district to the north, may simply be the latest, most brittle expression of a shear regime that was much more widespread in space and time. Features that are indicative of shear include ductile shear zones with sigmoidal foliation patterns, highly schistose zones with the development of shear bands, feldspar clasts or pyrite cubes with asymmetric pressure shadows, and the fact that the asymmetry of the F sub 2 folds is predominantly Z for at least 15 km south of the Vermilion fault. Author

**N86-23112*#** Natal Univ., Pietermaritzburg (South Africa). Dept. of Geology.
**A CONTINUOUS RECORD OF TECTONIC EVOLUTION FROM 3.5 Ga TO 2.6 Ga IN SWAZILAND AND NORTHERN NATAL**
D. R. Hunter, A. H. Wilson, J. A. Versfeld, A. R. Allen, R. G. Smith, D. W. W. Sleigh, P. B. Groenewald, G. M. Chutter, and V. A. Preston *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p64-68 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The approx. 3.5 Ga-old bimodal suite underlying an extensive area in southwestern Swaziland comprises the oldest-dated sialic rocks in the Kaapvaal structural province. The suite consists of leucocratic, layered tonalitic-trondhjemitic gneisses and amphibolites characterized by the effects of repeated high strains. This suite is considered to represent a sialic basement on which metavolcanic and metasedimentary rocks, now preserved as scattered greenstone remnants, accumulated. Direct evidence to confirm this temporal relationship is lacking, but structural data from the Dwalile, Assegaai and Commondale areas indicate that (1) the bimodal gneisses experienced a complex structural history prior to the first recognizable deformation in the supracrustal rocks (i.e., D1 in the supracrustals is equivalent to Dn + 1 in the gneisses) and (2) scattered remnants of the Dwalile rocks infolded with the bimodal suite structurally overlie the gneisses and are preserved in synformal keels. Significant proportions of metaquartzites and metapelites are present in the Assegaai greenstone sequence, the presence of which implies the existence of felsic crust in the source area from which these sediments were derived, a conclusion that is consistent with the structural data. Author

**N86-23113*#** Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
**IS THE CAMERON RIVER GREENSTONE BELT ALLOCHTHONOUS?**
Timothy M. Kusky *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 69-71 refs Sponsored in part by the Geological Society of America (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

Many tectonic models for the Slave Province, N.W.T., Canada, and for Archean granite - greenstone terranes in general, are implicitly dependent on the assumption that greenstone belt lithologies rest unconformably upon older gneissic basement. Other models require originally large separations between gneissic terranes and greenstone belts. A key question relating to the tectonics of greenstone belts is therefore the original spatial relationship between the volcanic assemblages and presumed-basement gneisses, and how this relationship has been modified by subsequent deformation. What remains unclear in these examples is the significance of the so-called later faulting of the greenstone - gneiss contacts. Where unconformities between gneisses and overlying sediments are indisputable, such as at Point Lake, the significance of faults which occur below the base of the volcanic succession also needs to be evaluated. As part of an on-going investigation aimed at answering these and other questions, the extremely well-exposed Cameron River Greenstone Belt and the Sleepy Dragon Metamorphic Complex in the vicinity of Webb Lake and Sleepy Dragon Lake was mapped. Author

**N86-23114*#** Louisiana State Univ., Baton Rouge. Dept. of Geology.
**SEDIMENTOLOGICAL AND STRATIGRAPHIC EVOLUTION OF THE SOUTHERN PART OF THE BARBERTON GREENSTONE BELT: A CASE OF CHANGING PROVENANCE AND STABILITY**
Donald R. Lowe and Gary R. Byerly *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 72-74 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The sedimentological and stratigraphic evolution of the 3.5 to 3.3 Ga Barberton Greenstone Belt can be divided into three principal stages: (1) the volcanic platform stage during which at least 8 km of mafic and ultramafic volcanic rocks, minor felsic volcanic units, and thin sedimentary layers (Onverwacht Group) accumulated under generally anorogenic conditions; (2) a transitional stage of developing instability during which widespread dacitic volcanism and associated pyroclastic and volcaniclastic sedimentation was punctuated by the deposition of terrigenous debris derived by uplift and shallow erosion of the belt itself (Fig Tree Group); (3) an orogenic stage involving cessation of active

volcanism, extensive thrust faulting, and widespread deposition of clastic sediments representing deep erosion of the greenstone belt sequence as well as sources outside of the belt (Moodies Group). Author

**N86-23115*#** Esso Australia Ltd., Sydney.
**EVIDENCE FOR STRUCTURAL STACKING AND REPETITION IN THE GREENSTONES OF THE KALGOORLIE DISTRICT, WESTERN AUSTRALIA**
J. E. Martyn *In* Lunar and Planetary Inst. Workshp on the Tectonic Evolution of Greenstone Belts 1986 p 75-77 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

Most previous stratigraphic interpretations of the southern part of the Norseman-Wiluna Greenstone Belt have proposed polycyclic sequences. These invoked two and sometimes three successive suites of mafic and/or ultimafic volcanics and intrusives separated by felsic volcanics and immature clastic sediments, however no distinctive lithological differences were reported between successive mafic-ultramaic sequences. When interpretations of the area further to the north are integrated, a total of four separate major mafic-ultramafic uites emerges for a large part of the Norseman-Wiluna Belt. Although the author does not intent to imply that all polycyclic stratigraphies are wrong in principle such a situation seems suspiciously over-complex and stimulates the need to look critically at the individual areas where the stratigraphies have seen erected. For the Kalgoorlie area in the south, some of the schemes have already provoked scepticism and a simpler model consisting of one cycle subject to structural repetition has been evolved by workers in the Geological Survey of Western Australia for part of this area. The latter drew attention to the carbon copy similarity between the elements of some polycyclic stratigraphies. Much more regionally extensive integrated structural and stratigraphic data is still required to evaluate the relationship between structure and stratigraphy more fully, an objective substantially limited by poor outcrop and deep weathering, but with due effort, far from unattainable. Author

**N86-23116*#** Massachusetts Univ., Amherst. Dept. of Geology and Geography.
**PRELIMINARY STRUCTURAL MODEL FOR THE SOUTHWESTERN PART OF THE MICHIPICOTEN GREENSTONE BELT, ONTARIO**
George E. Mcgill and Catherine H. Shrady *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 78-79 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The southwestern part of the Michipicoten Greenstone Belt includes a 100 sq km fume kill extending northeastwards from the twon of Wawa, Ontario. Except for a strip along the Magpie River that is covered by Pleistocene gravels, outcrop in the fume kill averages about 30-50%. Within this area are all the major lithologic belts characteristic of the southwestern fourth of the Michipicoten Greenstone Belt. All of the area mapped to date lies within Chabenel Township, recently mapped at 4' = 1 mile. Following a brief reconnaissance in 1983, mapping at a scale of 1' = 400' was begun within and adjacent to the fume kill in 1984. Two objectives are sought (1) determinaion of the geometry and sequence of folding, faulting, cleavage development, and intrusion; and (2) defining and tracing lithologic packages, and evaluating the nature of the contacts between these packages. Results for objective (1) are discussed in a companion abstract; this abstract will present tentative results for objective. Author

**N86-23117*#** Purdue Univ., West Lafayette, Ind. Dept. of Geosciences.
**THERMAL IMPLICATIONS OF METAMORPHISM IN GREENSTONE BELTS AND THE HOT ASTHENOSPHERE-THICK CONTINENTAL LITHOSHERE PARADOX**
Paul Morgan *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 81-83 refs (For primary document see N86-23089 13-46)
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From considerations of secular cooling of the Earth and the slow decay of radiogenic heat sources in the Earth with time, the conclusion that global heat loss must have been higher in the Archean than at present seems inescapable. The mechanism by which this additional heat was lost and the implications of higher heat low for crustal temperatures are fundamental unknowns in our current understanding of Archean tectonics and geological processes. Higher heat loss implies that the average global geothermal gradient was higher in the Archean than at present, and the restriction of ultramafic komatiites to the Archean and other considerations suggests that the average temperature of the mantle was several hundred degrees hotter during the Archean than today. In contrast, there is little petrologic evidence that the conditions of metamorphism or crustal thickness (including maximum crustal thickness under mountains) were different in archean continental crust from the Phanerozoic record. Additionally, Archean ages have recently been determined for inclusions in diamonds from Cretaceous kimeberlites in South Africa, indicating temperatures of 900 to 1300 at depths of 150 to 215 km (45 to 65 kbar) in the Archean mantle, again implying relatively low geothermal gradients at least locally in the Archean. The thermal implications of metamorphism are examined, with special reference to greenstone belts, and a new thermal model of the continental lithosphere is suggested which is consistent with thick continental lithosphere and high asthenosphere temperatures in the Archean. Author

**N86-23118*#** National Geophysical Research Inst., Hyderabad (India).
**GEOCHEMICAL CHARACTERS AND TECTONIC EVOLUTION OF THE CHITRADURGA SCHIST BELT: AN ARCHAEAN SUTURE (?) OF THE DHARWAR CRATON, INDIA**
S. M. Naqvi *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 84-85 (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The Chitradurga schist belt extending for about 450 km in a NS direction and 2-50 km across, is one of the most prominent Archean (2.6 b.y.) tectonic features of the Indian Precambrian terrain, comprising about 2 to 10 km thick sequence of volcano sedimentary rocks. The basal unit of this belt is composed of an orthoquartzite-carbonate facies, unlike many other contemporary greentone belts of the Gondwana land which begin with a basal mafic-ultramafic sequence. Eighty percent of the belt is made up of detrital and chemogenic sediments, their succession commencing with a poorly preserved quartz pebble basal conglomerate and current bedded quartzites which, in turn, rest on tonalitic gneisses, the latter having been further remobilized with along the schist belt. Deposition of current bedded matue arenites indicte the existence of platformal conditions near the shore line. Polymictic graywacke conglomerates, graywackes, shales, phyllites, carbonates, BIFs (oxide, carbonate and sulfide) BMF's (Banded Maganese Formations) and cherts thus constitute the main sedimentary rocks of the belt. The polymicitic conglomerates contain debris of rocks of older greenstone sequences, as well as an abundant measure of folded quartzites, BIF's and gneissic fragments which represent earlier orogenies. Author

**N86-23119*#** New Hampshire Univ., Durham. Dept. of Earth Sciences.
**GEOCHEMICAL AND ISOTOPIC CONSTRAINTS ON THE TECTONIC SETTING OF SERRA DOS CARAJAS BELT, EASTERN PARA, BRAZIL**
W. J. Olszewski, Jr., Allan K. Gibbs (Cornell Univ.,Ithaca, N.Y.), and Karl R. Wirth (Cornell Univ., Ithaca, N.Y.) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 86-88 refs (For primary document see N86-23089 13-46)
(Grant NSF EAR-84-10379)
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The lower part of the Serra dos Carajas belt is the metavolcanic and metasedimentary Grao para Group (GPG). The GPG is thought to unconformably overlie the older (but undated) Xingu Complex,

composed of medium and high-grade gneisses and amphibolite and greenstone belts. The geochemical data indicate that the GPG has many features in common with ancient and modern volcanic suites erupted through continental crust. The mafic rocks clearly differ from those of most Archean greenstone belts, and modern MORB, IAB, and hot-spot basalts. The geological, geochemical, and isotopic data are all consistent with deposition on continental crust, presumably in a marine basin formed by crustal extension. The isotopic data also suggest the existence of depleted mantle as a source for the parent magmas of the GPG. The overall results suggest a tectonic environment, igneous sources, and petrogenesis similar to many modern continental extensional basins, in contrast to most Archean greenstone belts. The Hammersley basin in Australia and the circum-Superior belts in Canada may be suitable Archean and Proterozoic analogues, respectively. F.M.R.

**N86-23120*#** Paris (I. A.), Paris (France).
**POLYPHASE THRUST TECTONIC IN THE BARBERTON GREENSTONE BELT**
I. A. Paris *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 89-90 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

In the circa 3.5 by-old Barberton greenstone belt, the supracrustal rocks form a thick and strongly deformed thrust complex. Structural studies in the southern part of the belt have shown that 2 separate phases of over-thrusting (D sub 1 and D sub 2) successively dismembered the original stratigraphy. Thrust nappes were subsequently refolded during later deformations (D sub 3 and D sub 4). This report deals with the second thrusting event which, in the study region appears to be dominant, and (unlike the earlier thrusting), affects the entire supracrustal pile. The supracrustal rocks form a predominantly NE/SW oriented, SE dipping tectonic fan (the D sub 2 fan) in which tectonic slices of ophiolitic-like rocks are interleaved with younger sedimentary sequences of the Diepgezet and malalotcha groups. Structural and sedimentological data indicate that the D sub 2 tectonic fan was formed during a prolonged, multi-stage regional horizontal shortening event during which several types of internal deformation mechanisms were successively and/or simultaneously active. Movement appears to have been predominantly to the NW and to the N. During D sub 2, periods of quiescence and sedimentation followed periods of thrust propagation. Although the exact kinematics which led to the formation of this fan is not yet known, paleoenvironmental interpretations together with structural data suggest that D sub 2 was probably related to (an) Archean collision(s). F.M.R.

**N86-23121*#** Geological Survey of Canada, Ottawa (Ontario).
**AGE CONSTRAINTS ON THE EVOLUTION OF THE QUETICO BELT, SUPERIOR PROVINCE, ONTARIO**
J. A. Percival and R. W. Sullivan *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 91-93 refs (For primary document see N86-23089 13-46)
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Much attention has been focused on the nature of Archean tectonic processes and the extent to which they were different from modern rigid-plate tectonics. The Archean Superior Province has linear metavolcanic and metasediment-dominated subprovinces of similar scale to cenozoic island arc-trench systems of the western Pacific, suggesting an origin by accreting arcs. Models of the evolution of metavolcanic belts in parts of the Superior Province suggest an arc setting but the tectonic environment and evolution of the intervening metasedimentary belts are poorly understood. In addition to explaining the setting giving rise to a linear sedimentary basin, models must account for subsequent shortening and high-temperature, low-pressure metamorphism. Correlation of rock units and events in adjacent metavolcanic and metasedimentary belts is a first step toward understanding large-scale crustal interactions. To this end, zircon geochronology has been applied to metavolcanic belts of the western Superior Province; new age data for the Quetico metasedimentary belt is reported, permitting correlation with the adjacent Wabigoon and Wawa metavolcanic subprovinces. Author

**N86-23122*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ARCHAEAN MEGACRYSTIC PLAGIOCLASE UNITS AND THE TECTONIC SETTING OF GREENSTONES**
W. C. Phinney, D. A. Morrison, and D. Maczuga (LEMSCO, Houston, Tex.) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 94-96 refs (For primary document see N86-23089 13-46)
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Large (up to 20 cm), equidimensional, commonly euhedral, plagioclase megacrysts of highly calcic composition (An sub 80-90) occur commonly in all Archean cratons in one or more of three distinct associations: (1) as cumulate crystal segregations of anorthosite or as megacrysts in basaltic dikes, sills, and flows in greenstone belts that vary in metamorphic grade from greenschist to granulite. Throughout 100's of thousands of square kilometers of northwestern Ontario and Manitoba the plagioclase megacrysts occur in pillowed and massive flows, sills, dikes, large inclusions in dikes, and intrusive anorthositic complexes with areas of up to a few 100 sq km and spanning a period of at least 100 m.y. in the 2.7 to 2.8 b.y. time frame; (2) as basaltic dike swarms in stable cratonic areas forming parallel to subparallel patterns over hundreds of thousands of square kilometers intruding both granitic gneisses and supracrustal belts including greenstones. These swarms include the Ameralik-Saglek system at 3.1 to 3.4 b.y., the Matachewan system at 2.5 to 2.6 b.y., and the Beartooth-Bighorn system at 2.2 to 2.3 b.y.; and, (3) as anorthositic complexes associated with marbles and quartzites (Sittampundi, India and Messina, South Africa) in granulite grade terrains. Initial attempts to correlate tectonic settings of similar modern crystbearing units with their Archean counterparts were only partially successful. Author

**N86-23123*#** Geological Survey of Canada, Ottawa (Ontario). Economic Geology and Mineralogy Div.
**RAINY LAKE WRENCH ZONE: AN EXAMPLE OF AN ARCHAEAN SUBPROVINCE BOUNDARY IN NORTHWESTERN ONTARIO**
K. Howard Poulsen *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 97-99 refs (For primary document see N86-23089 13-46)
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The Superior Province of the Canadian Shield comprises an alternation of subprovinces with contrasting lithological, structural and metamorphic styles. Rocks of the Rainly Lake area form a fault bounded wedge between two of these subprovinces, the Wabigoon granite-greenstone terrain to the north and the Quetico metasedimentary terrain to the south. The Quetico and Seine River-Rainy Lake Faults bound this wedge within which interpretation of the stratigraphy has been historically contentious. In the eastern part of the wedge, volcanic rocks and coeval tonalitic sills are unconformably overlain by fluviatile conglomerate and arenite of the Seine Group; in the western part of the wedge, metamorphosed wacke and mudstone of the Coutchiching Group are cut by granodioritic plutons. The Coutchiching Group has previously been correlated with the Seine Group and with the turbiditic Quetico metasediments of the Quetico Subprovince and these correlations are the cornerstone of earlier tectonic models which relate the subprovinces. The structural geology of the Rainy Lake area is characterized by attributes which compare favourably with the known characteristics of dextral wrench or 'transpressive zones based both on experimental data and natural examples. Much of this deformation involved the Seine Group, the youngest stratigraphic unit in the area, and predates the emplacement of late-to-post-tectonic granodioritic plutons for which radiometric data indicate a Late Archean age. Author

**N86-23124*#** Commonwealth Scientific and Industrial Research Organization, Ryde (Australia). Div. of Mineral Physics and Mineralogy.

**A PALAEOMAGNETIC PERSPECTIVE OF PRECAMBRIAN TECTONIC STYLES**

P. W. Schmidt and B. J. J. Embleton *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 100-101 refs (For primary document see N86-23089 13-46)
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The considerable success derived from palaeomagnetic studies of Phanerozoic rocks with respect to the tectonic styles of continental drift and plate tectonics, etc., have not been repeated by the many palaeomagnetic studies of Precambrian rocks. There are 30 years of research with results covering the major continents for Precambrian times that overlap considerably yet there is no concensus. There is good evidence that the usual assumptions employed by palaeomagnetism are valid for the Precambrian. The exisence of magnetic reversals during the Precambrian, for instance, is difficult to explain except in terms of a geomagnetic field that was predominantly dipolar in nature. It is a small concession to extend this notion of the Precambrian geomagnetic field to include its alignment with the Earth's spin axis and the other virtues of an axial geocentric dipole that characterize the recent geomagnetic field. In terms of greenstone terranes it is obvious that tectonic models postulated to explain these observations are paramount in understanding Precambrian geology. What relevance the current geographical relationships of continents have with their Precambrian relationships remains a paradox, but it would seem that the ensialic model for the development of greenstone terranes is favored by the Precambrian palaeomagnetic data.
F.M.R.

**N86-23125*#** Geological Survey, Reston, Va.

**THE WISCONSIN MAGMATIC TERRANE: AN EARLY PROTEROZOIC GREENSTONE-GRANITE TERRANE FORMED BY PLATE TECTONIC PROCESSES**

Klaus J. Schulz and Gene L. LaBerge (Wisconsin Univ., Oshkosh) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 102-104 refs (For primary document see N86-23089 13-46)
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The Wisconsin magmatic terrane (WMT) is an east trending belt of dominantly volcanic-plutonic complexes of Early Proterozoic age (approx. 1850 m.y.) that lies to the south of the Archean rocks and Early Proterozoic epicratonic sequence (Marquette Range Supergroup) in Michigan. It is separated from the epicratonic Marquette Range Supergroup by the high-angle Niagara fault, is bounded on the south, in central Wisconsin, by Archean gneisses, is truncated on the west by rocks of the Midcontinent rift system, and is intruded on the east by the post-orogenic Wolf river batholith. The overall lithologic, geochemical, metallogenic, metamorphic, and deformational characteristics of the WMT are similar to those observed in recent volcanic arc terranes formed at sites of plate convergence. It is concluded that the WMT represents an evolved oceanic island-arc terrane accreated to the Superior craton in the Early Proterozoic. This conclusion is strengthened by the apparent absence of Archean basement from most of the WMT, and the recent recognition of the passive margin character of the epicratonic Marquette Range Supergroup.
F.M.R.

**N86-23126*#** Toronto Univ. (Ontario). Dept. of Geology.

**NEW INSIGHTS INTO TYPICAL ARCHAEAN STRUCTURES IN GREENSTONE TERRANES OF WESTERN ONTARIO Abstract Only**

W. M. Schwerdtner *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 105 (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

Ongoing detailed field work in selected granitoid complexes of the western Wabigoon and Wawa Subprovinces, southern Canadian Shield, has led to several new conclusions: (1) Prominent gneiss domes are composed of prestrained tonalite-granodiorite and represent dense hoods of magmatic granitoid diapirs; (2) the deformation history of the prestrained gneiss remains to be unraveled; (3) the gneiss lacked a thick cover of mafic metavolcanics or other dense rocks at the time of magmatic diaprisim; (4) the synclinoral structure of large greenstone belts is older than the late gneiss domes and may have been initiated by volcanotectonic processes; (5) small greenstone masses within the gneiss are complexly deformed, together with the gneiss; and, (6) no compelling evidence has been found of ductile early thrusting in the gneiss terranes. Zones of greenstone enclaves occur in hornblende-rich contaminated tonalite and are apt to be deformed magmatic septa. Elsewhere, the tonalite gneiss is biotite-rich and hornblende-poor. These conclusions rest on several new pieces of structural evidence; (1) oval plutons of syenite-diorite have magmatic strain fabrics and sharp contacts that are parallel to an axial-plane foliation in the surrounding refolded gneiss; (2) gneiss domes are lithologically composite and contain large sheath-like structures which are deformed early plutons, distorted earlier gneiss domes, or early ductile nappes produced by folding of planar plutonic septa, and (3) the predomal attitudes of gneissosity varied from point to point.
Author

**N86-23127*#** Massachusetts Univ., Amherst. Dept. of Geology and Geography.

**DEFORMATIONAL SEQUENCE OF A PORTION OF THE MICHIPICOTEN GREENSTONE BELT, CHABANEL TOWNSHIP, ONTARIO**

Catherine H. Shrady and George E. McGill *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 106-107 refs (For primary document see N86-23089 13-46)
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Detailed mapping at a scale of one inch = 400 feet is being carried out within a fume kill, having excellent exposure, located in the southwestern portion of the Michipicoten Greenstone Belt near Wawa, Ontario. The rocks are metasediments and metavolcanics of lower greenschist facies. U-Pb geochronology indicates that they are at least 2698 + or - 11 Ma old. The lithologic packages strike northeast to northwest, but the dominant strike is approximately east-west. Sedimentary structures and graded bedding are well preserved, aiding in the structural interpretation of this multiply deformed area. At least six phases of deformation within a relatively small area of the Michipicoten Greenstone Belt have been tentatively identified. These include the following structural features in approximate order of occurrence: (0) soft-sediment structures; (1) regionally overturned rocks, flattened pebbles, bedding parallel cleavage, and early, approximately bedding parallel faults; (2) northwest to north striking cleavage; (3) northeast striking cleavage and associated folds, and at least some late movement on approximately bedding parallel faults; (4) north-northwest and northeast trending faults; and (5) diabase dikes and associated fracture cleavages. Minor displacement of the diabase dikes occurs on faults that appear to be reactivated older structures.
F.M.R.

**N86-23128*#** McGill Univ., Montreal (Quebec). Dept. of Geological Sciences.

**A CONTINENTAL RIFT MODEL FOR THE LA GRANDE GREENSTONE BELT**

T. Skulski, A. Hynes, M. Liu (Arizona Univ., Tucson), D. Francis, B. Rivard, and K. Stamatelopoulou-Seymour (Concordia Univ., Montreal, Canada) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 108-110 refs (For primary document see N86-23089 13-46)
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Stratigraphic relationships and the geochemistry of volcanic rocks contrain the nature and timing of the tectonic and magmatic processes in the pre-deformational history of the La Grande greenstone belt in the Superior Province of north-central Quebec. The lowermost supracrustals in this belt are obscured by syntectonic granitoid intrusives. The supracrustal succession in the western part of the belt consists of a lower sequence of immature clastic sediments and mafic volcanoclastics, overlain by pillowed and massive basalts. Further east, along tectonic strike, a lower sequence of mafic volcanoclastics and immature clastic sediments is overlain by a thick sequence of pillowed and massive basalts, and resedimented coarse clastic sediments and banded

iron formation. These are overlain by assive basaltic andesites, andesites and intermediate volcanoclastics intercalated with immature clastic sediments. In contrast, in the eastern part of the belt lenses of felsic volcanics and volcanoclastics occur at the base of the succession and pillowed and massive basalts are overlain by komatiites at the top. The La Grande greenstone belt can be explained as the product of continental rifting. The restricted occurence of komatiites, and eastwardly directed paleocurrents in clastic sediments in the central part of the belt are consistent with rifting commencing in the east and propagating westward with time. The increase in depth of emplacement and deposition with time of the lower three units in the central part of the belt reflects deposition in a subsiding basin. These supracrustal rocks are believed to represent the initial rift succession. F.M.R.

**N86-23129*#** Rand Afrikaans Univ., Johannesburg (South Africa). Dept. of Geology.
**TWO CONTRASTING METAMORPHOSED ULTRAMAFIC-MAFIC COMPLEXES FROM GREENSTONE BELTS, THE NORTHERN KAAPVAAL CRATON AND THEIR SIGNIFICANCE IN ARCHAEN TECTONICS**
C. A. Smit and J. R. Vearncombe *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 111-113 (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The character of Archaean ultramafic-mafic complexes can, given their prominance in greenstone belts, provide critical clues to help deduce the tectonic setting of these belts. Here are described two contrasting, metamorphosed, ultramafic-mafic complexes, the first a partially serpentinized dunitic body with associated chromite from Lemoenfontein, one of several peridotitic bodies occurring as discrete lenses and pods in granulite facies gneisses of the northern Kaapvaal craton. The second, the Rooiwater complex is a major layered igneous body, now metamorphosed in the amphibolite facies, but without pervasive deformation, which crops out in the northern Murchison greenstone belt. The Lemoenfontein chromites and associated ultramafic rocks are lithologically and chemically similar to their Phanerozoic equivalents of ophiolitic origin, interpreted as obducted oceanic crust. The Lemoenfontein complex is a remnant of Archaean oceanic material. In contrast, the Rooiwater complex is, despite the lack of exposed intrusive contacts, similar to layered igneous complexes such as Ushushwana or Bushveld. These complexes are intrusive in continental environments. It is concluded that contrasting ultramafic-mafic complexes represent a heterogeneity in greenstone belts with either oceanic or continental environments involved. F.M.R.

**N86-23130*#** Toronto Univ. (Ontario). Div. of Geophysics.
**ZIRCON Lu-Hf SYSTEMATICS: EVIDENCE FOR THE EPISODIC DEVELOPMENT OF ARCHAEAN GREENSTONE BELTS**
P. E. Smith, M. Tatsumoto (Geological Survey, Federal Center, Miss.), and R. M. Farquhar *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 114-116 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

A combined U-Th-Pb and Lu-Hf isotopic study of zircons was undertaken in order to determine the provenance and age of an Archean granite-greenstone terrain and to test the detailed application of the Lu-Hf system in various Archean zircons. The eastern Wawa subprovince of the Superior province consists of the low grade Michipicoten and Gamitagama greenstone belts and the granitic terrain. The Hf isotopic data indicate that the typical lithological features of a greenstone belt cycle could be accommodated in a crustal growth model that involved decreasing depth of melting in three isotopically distinct reservoirs: mantle, lower crust and upper crust. The model age of the sources given by the intersection of the lower crustal curve with the bulk earth evolution curve is about 2900 My, in good agreement with the zircon U-Pb basement age. This linear array also has a similar intersection age to that of Proterozoic carbonatite complexes. The general convergence of the other reservoir vectors around this age suggests that mantle depletion, crustal extraction and intracrustal ifferentiation were all part of the same episodic event. It is also apparent that recycling of older basement was important in the formation of many of the later greenstone belt rocks. F.M.R.

**N86-23131*#** Geomysore Services, Bangalore (India).
**EARLY PRECAMBRIAN CRUSTAL EVOLUTION OF SOUTH INDIA Abstract Only**
R. Srinivasan *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 117 (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The Early Precambrian sequence in Karnataka, South India provides evidences for a distinct trend of evolution which differs from trends exhibited in many other Early Precambrian regions of the world. The supracrustal rock associations preserved in greenstone belts and as inclusions in gneisses and granulites suggest the evolution of the terrain from a stable to a mobile regime. The stable regime is represented by (1) layered ultramafic-mafic complexes, (2) orthoquartzite-basalt-rhyodacite-iron formation, and (30 ortho-quartzite-carbonate-Mn-Fe formation. The mobile regime, which can be shown on sedimentological grounds to have succeeded the stable regime, witnessed the accumulation of a greywacke-pillow basalt-dacite-rhyolite-iron formation association. Detrital sediments of the stable zone accumulated dominantly in fluvial environment and the associated volcanics are ubaerial. The volcanics of the stable regime are tholeiites derived from a zirconium and LREE-enriched sources. The greywackes of the mobile regime are turbidities, and the volcanic rocks possess continental margin (island-arc or back-arc) affinity; they show a LREE depleted to slightly LREE-enriched pattern. The evolution from a stable to a mobile regime is in contrast to the trend seen in most other regions of the world, where an early dominantly volcanic association of a mobile regime gives way upward in the sequence to sediments characteristic of a stable regime. Author

**N86-23132*#** Geological Survey of Canada, Ottawa (Ontario).
**BASEMENT-COVER RELATIONS AND INTERNAL STRUCTURE OF THE CAPE SMITH KLIPPE: A 1.9 Ga GREENSTONE BELT IN NORTHERN QUEBEC, CANADA**
M. R. St-Onge, P. F. Hoffman, S. G. Lucas (Brown Univ., Providence, R.I.), D. J. Scott (McMaster Univ., Hamilton, Ontario), and N. J. Begin (Queen's Univ., Kingston, Ontario) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 118-119 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The Cape Smith Belt is a 380x60 km tectonic klippe composed of greenschistto amphibolite-grade mafic and komatiitic lava flows and fine-grained quartzose sediment, intruded by minor syn- to post-tectonic granitoids. Previously studied transects in areas of relatively high structural level show that the belt is constructed of seven or more north-dipping thrust sheets which verge toward the Superior Province (Archean) foreland in the south and away from an Archean basement massif (Kovik Antiform) external to the Trans-Hudson Orogen (Early Proterozoic) in the north. A field project (mapping and structural-stratigraphic-metamorphic studies) directed by MRS was begun in 1985 aimed at the structurally deeper levels of the belt and underlying basement, which are superby exposed in oblique cross-section (12 km minimum structural relief) at the west-plunging eastern end of the belt. Mapping now complete of the eastern end of the belt confirms that all of the metavolcanic and most of the metasedimentary rocks are allochthonous with respect to the Archean basement, and that the thrusts must have been rooted north of Kovik Antiform. The main findings follow. Author

**N86-23133*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**RHYOLITIC COMPONENTS OF THE MICHIPICOTEN GREENSTONE BELT, ONTARIO: EVIDENCE FOR LATE ARCHAEN INTRACONTINENTAL RIFTS OR CONVERGENT PLATE MARGINS IN THE CANADIAN SHIELD?**
Paul J. Sylvester, Kodjo Attoh (Hope Coll., Holland, Mich.), and

Klaus J. Schulz (Geological Survey, Reston, Va.) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 120-122 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

Rhyolitic rocks often are the dominant felsic end member of the biomodal volcanic suites that characterize many late Archean greenstone belts of the Canadian Shield. The rhyolites primarily are pyroclastic flows (ash flow tuffs) emplaced following plinian eruptions, although deposits formed by laval flows and phreatomagmatic eruptions also are presented. Based both on measured tectono-stratigraphic sections and provenance studies of greenstone belt sedimentary sequences, the rhyolites are believed to have been equal in abundance to associated basaltic rocks. In many recent discussions of the tectonic setting of late Archean Canadian greenstone belts, rhyolites have been interpreted as products of intracontinental rifting . A study of the tectono-stratigraphic relationships, rock associations and chemical characteristics of the particularly ell-exposed late Archean rhyolites of the Michipicoten greenstone belt, suggests that convergent plate margin models are more appropriate. Author

**N86-23134*#** Department of Energy, Mines, and Resources, Ottawa (Ontario). Earth Physics Branch.
**GEOPHYSICAL CHARACTERISTICS AND CRUSTAL STRUCTURE OF GREENSTONE TERRANES: CANADIAN SHIELD**
M. D. Thomas, L. Losier (McGill Univ., Montreal, Canada), P. C. Thurston (Ontario Geological Survey, Toronto), V. K. Gupta (Ontario Geological Survey, Toronto), R. A. Gibb, and R. A. F. Grieve *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 123-125 refs (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

Geophysical studies in the Canadian Shield have provided some insights into the tectonic setting of greenstone belts. Greenstone belts are not rooted in deep crustal structures. Geophysical techniques consistently indicate that greenstones are restricted to the uppermost 10 km or so of crust and are underlain by geophysically normal crust. Gravity models suggest that granitic elements are similarly restricted, although magnetic modelling suggests possible downward extension to the intermediate discontinuity around approx. 18 km. Seismic evidence demonstrates that steeply-dipping structure, which can be associated with the belts in the upper crust, is not present in the lower crust. Horizontal intermediate discontinuities mapped under adjacent greenstone and granitic components are not noticeably disrupted in the boundary zone. Geophysical evidence points to the presence of discontinuities between greenhouse-granite and adjacent metasedimentary erranes. Measured stratigraphic thicknesses of greenstone belts are often twice or more the vertical thicknesses determined from gravity modelling. Explantations advanced for the discrepancy include stratigraphy repeated by thrust faulting and/or listric normal faulting, mechanisms which are consistent with certain aspects of conceptual models of greenstone development. Where repetition is not a factor the gravity evidence points to removal of the root zones of greenstone belts. For one region, this has been attributed to magmatic stopping during resurgent caldera activity. F.M.R.

**N86-23135*#** Geo ogical Survey of Canada, Toronto (Ontario).
**VOLCANOLOGICAL CONSTRAINTS OF ARCHAEAN TECTONICS**
P. C. Thurston and L. D. Ayres (Manitoba Univ., Winnipeg) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 126-128 (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

Volcanological and trace element geochemical data can be integrated to place some constraints upon the size, character and evolutionary history of Archean volcanic plumbing, and hence indirectly, Archean tectonics. The earliest volcanism in any greenhouse belt is almost universally tholeitic basalt. Archean mafic magma chambers were usually the site of low pressure fractionation of olivine, plagioclase and later Cpx + or - an oxide phase during evolution of tholeitic liquids. Several models suggest basalt becoming more contaminated by sial with time. Data in the Uchi Subprovince shows early felsic volcanics to have fractionated REE patterns followed by flat REE pattern rhyolites. This is interpreted as initial felsic liquids produced by melting of a garnetiferous mafic source followed by large scale melting of LIL-rich sial. Rare andesites in the Uchi Subprovince are produced by basalt fractionation, direct mantle melts and mixing of basaltic and tonalitic liquids. Composite dikes in the Abitibi Subprovince have a basaltic edge with a chill margin, a rhyolitic interior with no basalt-rhyolite chill margin and partially melted sialic inclusions. Ignimbrites in the Uchi and Abitibi Subprovinces have mafic pumice toward the top. Integration of these data suggest initial mantle-derived basaltic liquids pond in a sialic crust, fractionate and melt sial. The inirial melts low in heavy REE are melts of mafic material, subsequently melting of adjacent sial produces a chamber with a felsic upper part underlain by mafic magma. Author

**N86-23136*#** Rand Afrikaans Univ., Johannesburg (South Africa). Dept. of Geology.
**THE DEHYDRATION, REHYDRATION AND TECTONIC SETTING OF GREENSTONE BELTS IN A PORTION OF THE NORTHERN KAAPVAAL CRATON, SOUTH AFRICA**
D. D. vanReenen, J. M. Barton, Jr., C. Roering, J. C. vanSchalkwyk, C. A. Smit, J. D. deBeer (CSIR, Pretoria, South Africa), and E. H. Stettler (Geological Survey, Pretoria, South Africa) *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 129-131 (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

High-grade gneiss terranes and low-grade granite-greenstone terranes are well known in several Archaean domains. The geological relationship between these different crustal regions, however, is still controversial. One school of thought favors fundamental genetic differences between high-grade and low-grade terranes while others argue for a depth-controlled crustal evolution. The detailed examination of well-exposed Archaean terranes at different metamorphic grades, therefore, is not only an important source of information about the crustal levels exposed, but also is critical to the understanding of the possible tectonic and metamorphic evolution of greenstone belts with time. Three South African greenstone belts are compared. Author

**N86-23137*#** Saskatchewan Univ., Saskatoon. Dept. of Geological Sciences.
**THE STRATIGRAPHY OF THE STEEP ROCK GROUP, N.W. ONTARIO, WITH EVIDENCE OF A MAJOR UNCONFORMITY**
M. E. Wilks and E. G. Nisbet *In* Lunar and Planetary Inst. Workshop on the Tectonic Evolution of Greenstone Belts 1986 p 132-134 ref (For primary document see N86-23089 13-46)
Avail: NTIS HC A07/MF A01 CSCL 08G

The Steep Rock Group is exposed 6 km north of Atikokan, 200 km west of Thunder Bay. It is situated on the southern margin of the Wabigoon Belt of the Archaean Superior Province, N. W. Ontario. Reinvestigation of the geology of the Group has shown that the Group lies unconformably on the Tonalite Complex to the east. This unconformity has been previously suspected, from regional and ine mapping but no conclusive outcrop evidence for its existence has as yet been published. The strike of the group, comprised of Basal Conglomerate, Carbonate Member, Ore Zone and Ashrock is generally north-northwest dipping steeply to the southwest. Of the 7 contacts between the Steep Rock Group and the Tonalite Complex, 3 expose the unconformity (The Headland, S. Roberts Pit, Trueman Point), and 4 are faulted. These three outcrops demonstrate unequivocally that the Steep Rock group was laid down unconformably on the underlying Tonalite Complex, which is circa 3 Ga old. Author

**N86-23138*#** Maryland Univ., College Park. Inst. for Physical Science and Technology.
**SPECTRAL STUDIES RELATED TO DISSOCIATION OF HBr, HCl AND BrO Final Technical Report**
Marshall L. Ginter Mar. 1986 92 p refs

(Grant NsG-7340)
(NASA-CR-176698; NAS 1.26:176698) Avail: NTIS HC A05/MF A01 CSCL 04A

Concern over halogen catalyzed decomposition of O3 in the upper atmosphere has generated need for data on the atomic and molecular species X, HX and XO (where X is Cl and Br). Of special importance are Cl produced from freon decomposition and Cl and Br produced from natural processes and from other industrial and agricultural chemicals. Basic spectral data is provided on HCl, HBr, and BrO necessary to detect specific states and energy levels, to enable detailed modeling of the processes involving molecular dissociation, ionization, etc., and to help evaluate field experiments to check the validity of model calculations for these species in the upper atmosphere. Results contained in four published papers and two major spectral compilations are summarized together with other results obtained. Author

**N86-23139*#** California Inst. of Tech., Pasadena. Seismological Lab.
**THE SIZE DISTRIBUTIONS OF FRAGMENTS EJECTED AT A GIVEN VELOCITY FROM IMPACT CRATERS**
John D. OKeefe and Thomas J. Ahrens 2 Apr. 1986 18 p refs (Grant NsG-7129)
(NASA-CR-176697; NAS 1.26:176697) Avail: NTIS HC A02/MF A01 CSCL 08K

The mass distribution of fragments that are ejected at a given velocity for impact craters is modeled to allow extrapolation of laboratory, field, and numerical results to large scale planetary events. The model is semi-empirical in nature and is derived from: (1) numerical calculations of cratering and the resultant mass versus ejection velocity, (2) observed ejecta blanket particle size distributions, (3) an empirical relationship between maximum ejecta fragment size and crater diameter, (4) measurements and theory of maximum ejecta size versus ejecta velocity, and (5) an assumption on the functional form for the distribution of fragments ejected at a given velocity. This model implies that or planetary impacts into competent rock, the distribution of fragments ejected at a given velocity is broad, e.g., 68% of the mass of the ejecta at a given velocity contains fragments having a mass less than 0.1 times a mass of the largest fragment moving at that velocity. The broad distribution suggests that in impact processes, additional comminution of ejecta occurs after the upward initial shock has passed in the process of the ejecta velocity vector rotating from an initially downward orientation. This additional comminution produces the broader size distribution in impact ejecta as compared to that obtained in simple brittle failure experiments. Author

**N86-23140#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**PREDICTION POSSIBILITIES OF AROSA TOTAL OZONE**
R. P. Kane Jan. 1986 20 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico Submitted for publication
(INPE-3755-PRE/878) Avail: NTIS HC A02/MF A01

Using the periodicities obtained by a Maximum Entropy Spectral Analysis (MESA) of the Arosa total ozone data (CC') series for 1932 to 1971, the values predicted for 1972 onwards were compared with the observed values of the (AD) series. A change of level was noticed, with the observed (AD) values lower by about 7 D.U. Also, the matching was poor in 1980, 1981, 1982. It is suspected that some of the periodicities may be of a transient nature, with amplitudes and/or phases varying with time. Author

**N86-23141#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**COMMENT ON GENERAL THEORY OF THE ALKALI METALS PRESENT IN THE EARTH'S UPPER ATMOSPHERE**
Volker W. J. H. Kirchhoff Jan. 1986 17 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico Submitted for publication
(INPE-3784-PRE/881) Avail: NTIS HC A02/MF A01

Workers at the French observatory of Haute Provence published a theoretical work, General Theory of the Alkali Metals Present in the Earth's Upper Atmosphere, in three parts, separately analyzing the layer model, the seasonal variations, and the diurnal variations. The papers fail to achieve the objectives proclaimed in their titles and appear to be misleading. Several inconsistencies are discussed. B.G.

**N86-23142#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**MEASUREMENTS OF ATMOSPHERIC X AND GAMMA RAYS-BALLOON EXPERIMENTS AT SUBANTARCTIC REGION**
U. B. Jayanthi, R. V. Correa, and F. G. Blanco Jan. 1986 19 p refs Presented at the I Simposio Regional da Sociedade Brasileira de Geofisica, Sao Jose dos Campos, Brazil, 27-29 Nov. 1985 Sponsored in part by Comissao Interministerial para os Recursos do Mar
(INPE-3780-PRE/879) Avail: NTIS HC A02/MF A01

The results of two stratospheric balloon experiments conducted to measure the atmospheric X-and gamma rays are presented. These experiments, conducted at Comandante Ferraz base in subantarctic region, have provided the spectrum of ground radioactivity in gamma rays (0.2 to 2.9 MeV) and atmospheric X-ray spectra at different altitudes. The observed ceiling spectrum of X-rays in the 28 to 180 KeV region observed at 7.0 g/sq cm are discussed. The data of other experiments with different telescope geometrics were utilized to evaluate the buildup effects due to cosmic ray secondaries in atmosphere. This behavior previously studied for atmospheric gamma rays, permitted the comparison of the up/down flux ratios to explain the observed atmospheric X-ray spectrum. Author

**N86-23143** British Antarctic Survey, Cambridge (England).
**GEOMAGNETIC MEASUREMENTS AT SOUTH GEORGIA 1975-1982**
D. A. Simmons 1985 170 p refs
(ISBN-0-85665-111-7) Copyright. Avail: Issuing Activity

The results are given of the geomagnetic measurements made at South Georgia from January 1975 to March 1982. Full details of the site, the variometers and the absolute instruments are included. The installation of the La Cour magnetograph and the fluxgate magnetometer are described together with the calibration and use of the absolute instruments. The method of computing mean hourly values is described and the accuracy and reliability of the data is discussed. It is concluded that, apart from a possible discontinuity of approximately 5 nT in Z between December 1977 and January 1978, the mean s of H and Z are correct to + or - 6 nT throughout the time. Summary tables of monthly and annual means are provided for the three components H, D and Z as well as tables of hourly means for the whole period. Tables of the K indices are also provided. Author

**N86-23144** British Antarctic Survey, Cambridge (England).
**GEOMAGNETIC MEASUREMENTS AT ARGENTINE ISLANDS 1957-1982**
P. A. Salino 1985 81 p refs
(ISBN-0-85665-114-1) Copyright. Avail: Issuing Activity

The operation of the magnetic observatory on the Argentine Islands from its opening in 1957 to the end of the 1982 are described. Full details of the site, buildings, instruments, and their operation are given. A normal and an insensitive La Cour Magnetograph were installed in 1955 and repositioned in l971 and 1970 respectively. The Quartz Horizontal Magnetometer (OHM) was used throughout for measuring the horizontal component, a Quartz Declinometer replaced the Kew pattern magnetometer for measuring declination 1982 and the Proton Precission Magnetometers (PPM) replaced the Magnetometric Zero Balances (BMZ) for calculating the vertical component in 1979. The method of computing mean hourly values is described and the accuracy and reliability of the data is described and the accuracy and reliability of the data is discussed. Tables are given listing the monthly and annual means, and listing the mean diurnal variation for each month. These tables are for the H, D and Z components and list values for all days, quiet days and disturbed days. Author

**N86-23145#** Pacific-Sierra Research Corp., Los Angeles, Calif.
**IONOSPHERIC MODIFICATION WITH OBLIQUELY INCIDENT WAVES: ELECTRON HEATING AND PARAMETRIC INSTABILITIES Interim Report, Dec. 1983 - Mar. 1985**
E. C. Field, Jr. and C. R. Warber Oct. 1985 45 p
(Contract F19628-84-C-0014)
(AD-A162603; PSR-1506; RADC-TR-85-188) Avail: NTIS HC A03/MF A01 CSCL 04/1

Nearly all ionospheric modification experiments have been carried out with the modifying wave at vertical incidence. For many applications, however, the modifying wave would probably be at oblique incidence. This report identifies nonlinear phenomena tha could be caused by obliquely incident modifying waves. It concentrates on phenomena that might enhance or degrade the performance of high frequency (HF) radar or communications systems. The nonlinear processes that lead to ionospheric modification divide naturally into two categories: (1) ohmic heating, which alters temperature and hence, reaction rates, collision frequencies, and particle densities, and (2) generation of parametric instabilities, which causes a myriad of phenomena. As the incidence angle is increased, heating is affected by two competing trends. It is weakened by the increased path length, but is strengthened near caustics. A transmitter with a power-gain product on the order of 10 MW can launch and oblique wave strong enough to produce electric fields of several tenths of a volt per meter or more in the ionosphere. Such fields produce substantial temperature increases, which are initially concentrated near the caustics, but spread via heat conduction. GRA

**N86-23146#** Utah Univ., Salt Lake City. Earth Sciences Lab.
**PW2D FINITE ELEMENT PROGRAM FOR SOLUTION OF MAGNETOTELLURIC RESPONSES OF TWO-DIMENSIONAL EARTH RESISTIVITY STRUCTURE. USER DOCUMENTATION**
P. E. Wannamaker, J. A. Stodt, and L. Rijo Sep. 1985 75 p refs
(Contract DE-AC03-84SF-12196)
(DE86-002009; DOE/SAN-12196/13; ESL-158) Avail: NTIS HC A04/MF A01

Algorithm PW2D is a finite element program for simulation of magnetotelluric responses of two-dimensional earth resistivity structure. Linear interpolation of the unknown field parallel to strike over triangular subdomains is utilized in conjunction with the Galerkin method of basis weighting to derive a system of linear equations which approximates the governing Helmholtz equation. From the field parallel to strike, the auxiliary vertical and transverse fields obtain from a numerical approximation to Maxwell's equations. Both transverse electric (TE) and transverse magnetic (TM) modes of plane-wave excitation can be modeled. The algorithm described herein unlike previous versions of the program solves directly for secondary variations in the field parallel to strike, plus the subsequent auxiliary fields. This approach has circumvented a difficulty with numerical precision at low frequencies observed in total field solutions for the TM mode especially, but also for the TE mode. DOE

**N86-23147#** Department of Energy, Washington, D. C.
**SUMMARIES OF PHYSICAL RESEARCH IN THE GEOSCIENCES**
Sep. 1985 161 p
(DE86-001832; DOE/ER-0145/3) Avail: NTIS HC A08/MF A01

The summaries in this document describe the scope of the individual programs and detail the research performed during 1983 to 1984. The Geosciences Research Program includes research in geology, petrology, geophysics, geochemistry, hydrology, solar-terrestrial relationships, aeronomy, seismology, and natural resource analysis, including their various subdivisions and interdisciplinary areas. DOE

**N86-23148#** Los Alamos National Lab., N. Mex.
**IMPULSIVE ION ACCELERATION IN EARTH'S OUTER MAGNETOSPHERE**
D. N. Baker and R. D. Belian 1985 31 p Presented at the Chapman Conference Ion Acceleration, Wellesley, Mass., 3 Jun. 1985
(Contract W-7405-eng-36)
(DE86-000772; LA-UR-85-3232; CONF-8506196-1) Avail: NTIS HC A03/MF A01

Evidence is found that ions are accelerated to high energies in the outer magnetosphere during geomagnetic disturbances. The acceleration often appears to be quite impulsive causing temporally brief (10's of seconds), very intense bursts of ions in the distant plasma sheet as well as in the near-tail region. These ion bursts extend in energy from 10's of keV to over 1 MeV and are closely associated with substorm expansive phase onsets. Although the very energetic ions are not of dominant importance for magnetotail plasma dynamics, they serve as an important tracer population. Their absolute intensity and brief temporal appearance bespeaks a strong and rapid acceleration process in the near-tail, very probably involving large induced electric fields substantially greater than those associated with cross-tail potential drops. Subsequent to their impulsive acceleration, these ions are injected into the outer trapping regions forming ion drift echo events, as well as streaming tailward away from their acceleration site in the near-earth plasma sheet. DOE

**N86-23149#** Institute of Oceanographic Sciences, Wormley (England).
**A COMPILATION OF GEOPHYSICAL DATA ON THE EAST GREENLAND CONTINENTAL MARGIN AND ITS USE IN GRAVITY MODELLING ACROSS THE CONTINENT-OCEAN TRANSITION**
C. I. Uruski and L. M. Parson 1985 53 p refs Sponsored by UK Department of Energy
(IOS-214) Avail: NTIS HC A04/MF A01

Magnetic, gravity, and seismic reflection data on the East Greenland continental margin were collected. The data were used to model the ocean-continent transition, and to study the nature and distribution of dipping, subacoustic basement (sub B) seismic reflector sequences. Post-reflector B sediments and the structure of the region are discussed. Author (ESA)

**N86-23150#** Global Geochemistry Corp., Canoga Park, Calif.
**ANALYSIS OF GASES IN THE EARTH'S CRUST Final Report, 1 Jan. 1982 - 28 Feb. 1985**
P. D. Jenden Jun. 1985 222 p
(Contract GRI-5081-360-0533)
(PB86-103843; GRI-85/0106) Avail: NTIS HC A10/MF A01 CSCL 08D

The composition of natural gas accumulations is controlled by many factors, including source material, burial depth, geothermal gradient, migration history and the presence of reservoir oxidants. In order to investigate these factors, and in particular, to evaluate the economic significance of abiogenic, deep-earth gas, six hundred crustal gases have been analyzed for chemical and stable isotopic composition. Numerous accessory samples of oil, core and cuttings materials, carbonate cement, pyrite, soil, and vegetation have also been analyzed. GRA

**N86-23151#** Illinois State Geological Survey, Champaign.
**EARLY PENNSYLVANIAN PALEOTOPOGRAPHY AND DEPOSITIONAL ENVIRONMENTS, ROCK ISLAND COUNTY, ILLINOIS, GUIDEBOOK**
R. L. Leary and C. B. Trask 1985 48 p Presented at the 19th Annual Meeting of the North-Central Section of the Geological Society of America, DeKalb, Ill., 25-27 Apr., 1985 Prepared in cooperation with Illinois State Museum, Springfield
(PB86-111648; IL/SGS/GB-18) Avail: NTIS HC A03/MF A01 CSCL 08G

The Geological Society of America, North-Central Section, presents a one-day field trip to Rock Island County, Illinois, where there will be the opportunity to examine the pre-Pennsylvanian unconformity, overlying sediments, and an early Pennsylvanian upland compression flora. The guidebook itself is a reprint of Leary (1979). Some revisions have been made to update the guidebook with new exposures, new data, and new references. The geology of the field-trip area has been discussed by Leary (1981). Phillips

and Pepers (1984) have summarized regional paleoenvironmental patterns of coal swamps and discussed the effect of climate on coal occurrence in Euramerican coal fields. GRA

**N86-23152#** Illinois State Water Survey, Champaign.
**GEOLOGICAL-GEOTECHNICAL STUDIES FOR SITING THE SUPERCONDUCTING SUPER COLLIDER IN ILLINOIS: PRELIMINARY GEOLOGICAL FEASIBILITY REPORT**
J. P. Kempton, R. C. Vaiden, D. R. Kolata, P. B. DuMontelle, and M. M. Killey 1985 100 p
(PB86-124989; IL/SGS/EGN-111) Avail: NTIS HC A05/MF A01 CSCL 08G

Site suitability was determined from a geological perspective. A preliminary compilation of existing geologic maps, reports, and other readily available geologic data is reported. Maps and cross sections were prepared to focus on the geologic units relevant to ring siting; geologic units were described and characterized to a geologically and economically practical depth (about 600 ft (180 m)). The data provide a provisional base for determining overall geologic suitability for locating an accelerator up to 30 miles (48 km) in diameter. Problem areas and areas and geologic units that appear most suitable for the ring are indicated. E.A.K.

**N86-23019#** Joint Publications Research Service, Arlington, Va.
**CRUSTAL MODELS FOR VARIOUS PACIFIC OCEAN BED STRUCTURES Abstract Only**
G. I. Semenova *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 16 Transl. into ENGLISH from Tikhookeanskaya Geologiya (Novosibirsk, USSR), no. 4, Jul. - Aug. 1985 p 3-12 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

# 47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

**N86-23153** Yale Univ., New Haven, Conn.
**THE DYNAMICS OF OROGRAPHIC RAIN WITH LARGE LATENT HEAT RELEASE Ph.D. Thesis**
Yuh-Lang Lin 1984 178 p
Avail: Univ. Microfilms Order No. DA8509739

In the analytical model, a time-dependent problem is solved for an elevated heat source turned on as a pulse in a moving fluid. There exists a region of growing upward displacement drifting with the mean wind, which develops with time until a maximum height is reached. The thermally induced circulation in the vicinity of this cloud is similar to that of a convective cloud in a quiescent fluid. The updraft at the center of the cloud is surrounded by compensating downdrafts. This downward displacement acts to limit the size and strength of the stationary orographic cloud. In the numerical model, the finite element Galerkin method is used to integrate the governing equations. A simple rain parameterization is used to simulate pseudoadiabatic process of rain formation. In a stable atmosphere, a locally steady state pattern of orographic cloud is reached as a drifting cloud departs downstream. The latent heating, gravity waves and mean wind are found to play important roles on the processes of cloud drifting, splitting and generation. Dissert. Abstr.

**N86-23154** Melbourne Univ., Carlton (Australia).
**ATMOSPHERIC CHARACTERISTICS INFERRED FROM ACOUSTIC RADAR DATA Ph.D. Thesis**
Gregory Stewart Robinson 1985 349 p
Avail: Univ. Microfilms Order No. DA8516425

The work in this thesis examined data collected from a 3-axis Doppler acoustic radar system. The majority of these data were collected at sub-tropical Australian sites where vigorous convective activity was sometimes encountered during the day. In all, several weeks of data were recorded. A brief discussion of this remote-sensing technique is presented, together with a description of the equipment used and the sites at which data were collected. The fundamental data consisted of the recorded spectra of individual atmospheric echoes. Methods for extracting low-level information from these methods are discussed. The extracted data are further processed with several aims. Some interdependences between spectral parameters that may complicate routine processing are isolated and discussed. The behavior of the three major descriptors of the echo spectra, echo power, spectral broadening and Doppler-shift are then discussed in detail. Dissert. Abstr.

**N86-23155** Columbia Univ., Palisades, N.Y.
**INTERACTIONS AMONG PLANETARY WAVES AND THE GENERATION OF TRAVELING LONG WAVES Ph.D. Thesis**
Walter A. Robinson 1985 275 p
Avail: Univ. Microfilms Order No. DA8523227

This thesis is an investigation of the mechanisms through which planetary waves interact. It is shown that waves interact when wave transience or dissipation causes wave-mean flow interactions, or when waves with different phase velocities coexist. These mechanisms are studied in a quasigeostrophic numerical model with 8 horizontal modes on 50 levels. Four different paradigms for wave-wave interactions are investigated. Wave-mean flow interactions resulting from dissipation cause interactions among stationary waves. The steady response of the model to stationary forcing is computed in order to elucidate the effects of wave-wave interactions on the structures of stationary waves. Wave-mean flow interactions resulting from wave transience also induce wave-wave interactions. Interactions between waves with different phase velocities are investigated by simultaneously forcing westward traveling and stationary waves. The results suggest an explanation for the observed negative correlation between the stratospheric amplitudes of waves 1 and 2. The interactions of traveling waves with stationary waves also lead to an instability of the stationary waves. Dissert. Abstr.

**N86-23156** Utah Univ., Salt Lake City.
**CLOUD AND RADIATION BUDGET STUDIES Ph.D. Thesis**
George Geoffrey Koenig 1985 320 p
Avail: Univ. Microfilms Order No. DA8522904

The development of cloud and ERB climatologies using the AFGWC3DNEPH cloud information and the Nimbus-7 ERB data is presented. The climatologies consist of daily, monthly, and diurnal monthly cloud and ERB information. The NEpH cloud climatologies are compared to existing cloud climatologies. In addition, the outgoing IR flux at the top of the atmosphere is computed using the University of Utah IR parameterization model. These fluxes are compared with the appropriate ERB fluxes. The difference between the ERB and the model is used to modify both the zonal cloud parameters and the cloud parameters associated with a number of specific grid points. Finally, the cloud ERB climatologies are used to determine the sensitivity of the outgoing long and shortwave flux and the net radiation to changes in the total cloud amount. Zonal and global averages of these sensitivity factors are calculated. The magnitude of these factors gives the relative importance of the albedo and greenhouse effects. Dissert. Abstr.

**N86-23157** New York Univ., New York.
**THREE-RESEVOIR MODELS FOR CLIMATE EVOLUTION WITH A TWO-DIMENSION WORLD OCEAN Ph.D. Thesis**
Ching-Tzong Hseh 1985 152 p
Avail: Univ. Microfilms Order No. DA8522044

A three reservioir parameterized climate model is formulated from the principle of energy balance. The system, composed of the atmosphere, ocean and land, covers pole-to-pole regions. The ocean part includes mixed layer and deep sea which has isopycnal structure. The model is designed to investigate the climatic responses to external and internal perturbations. Extent perturbations mainly refer to the seasonally varying solar radiation, whereas internal perturbations to the change of $CO_2$ concentration in the atmosphere. Seasonal responses to the seasonal variation of solar radiation for present $CO_2$ levels are tested to calibrate parameters of the model. Long term responses to the change of $CO_2$ level are also investigated. The model is coupled to curve-fit to a longwave radiation progam which calculates outgoing and downward longwave radiation. Steady state solutions are obtained by

giving step changes of CO2 level to the system, whereas transient solutions are obtained by giving a prescribed record of CO2. Zonally averaged temperatures at different latitudes are calculated. Temperature fields are obtained for air, water, land and ice temperatures. The calculated seasonal temperature field is compared with the observed data to test the performance of the model. Dissert. Abstr.

**N86-23158** Florida State Univ., Tallahassee.
**NUMERICAL WEATHER PREDICTION FOR THE WEST AFRICAN MONSOON EXPERIMENT Ph.D. Thesis**
Joseph Adefemi Adejokun 1985 382 p
Avail: Univ. Microfilms Order No. DA8522739

The West African Monsoon Experiment (WAMEX) took place between 1 May to 31 August, 1979, over an area from 10 S to 25 N and 25 W to 25 E. Data collected during WAMEX were analyzed by a WMO WAMEX scientific group which selected four cases of monsoon disturbances that passed across West Africa during the WAMEX period. The four WAMEX cases were subjected to detailed observational and numerical prediction studies. The prediction experiments are a series of real data numerical weather prediction carried out using two single level models and the FSU multilevel global spectral model. Both the FGGE III-b data and the objectively analyzed FGGE III-b plus WAMEX data sets are separately utilized in the observational study and in the numerical integrations in order to evaluate the impact of the WAMEX data set and also to determine which data produces wave structures and characteristics that are closest to actual observations. Results of the comparative observational study indicate positive correlation between both data sets with no significant difference. Dissert. Abstr.

**N86-23159*#** Oklahoma Univ., Norman. National Severe Storms Lab.
**ANALYSIS OF AIRBORNE DOPPLER LIDAR, DOPPLER RADAR AND TALL TOWER MEASUREMENTS OF ATMOSPHERIC FLOWS IN QUIESCENT AND STORMY WEATHER Contractor Report, 27 Apr. 1982 - 31 Jul. 1985**
H. B. Bluestein, R. J. Doviak, M. D. Eilts, E. W. McCaul, R. Rabin, A. Sundara-Rajan, and D. S. Zrnic Washington NASA Feb. 1986 178 p refs
(Contract NAS8-34749)
(NASA-CR-3960; NAS 1.26:3960) Avail: NTIS HC A09/MF A01 CSCL 04B

The first experiment to combine airborne Doppler Lidar and ground-based dual Doppler Radar measurements of wind to detail the lower tropospheric flows in quiescent and stormy weather was conducted in central Oklahoma during four days in June-July 1981. Data from these unique remote sensing instruments, coupled with data from conventional in-situ facilities, i.e., 500-m meteorological tower, rawinsonde, and surface based sensors, were analyzed to enhance understanding of wind, waves and turbulence. The purposes of the study were to: (1) compare winds mapped by ground-based dual Doppler radars, airborne Doppler lidar, and anemometers on a tower; (2) compare measured atmospheric boundary layer flow with flows predicted by theoretical models; (3) investigate the kinematic structure of air mass boundaries that precede the development of severe storms; and (4) study the kinematic structure of thunderstorm phenomena (downdrafts, gust fronts, etc.) that produce wind shear and turbulence hazardous to aircraft operations. The report consists of three parts: Part 1, Intercomparison of Wind Data from Airborne Lidar, Ground-Based Radars and Instrumented 444 m Tower; Part 2, The Structure of the Convective Atmospheric Boundary Layer as Revealed by Lidar and Doppler Radars; and Part 3, Doppler Lidar Observations in Thunderstorm Environments. Author

**N86-23160*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SITE SELECTION AND DIRECTIONAL MODELS OF DESERTS USED FOR ERBE VALIDATION TARGETS**
W. Frank Staylor Apr. 1986 15 p refs
(NASA-TP-2540; L-16041; NAS 1.60:2540) Avail: NTIS HC A02/MF A01 CSCL 04B

Broadband shortwave and longwave radiance measurements obtained from the Nimbus 7 Earth Radiation Budget scanner were used to develop reflectance and emittance models for the Sahara, Gibson, and Saudi Deserts. These deserts will serve as in-flight validation targets for the Earth Radiation Budget Experiment being flown on the Earth Radiation Budget Satellite and two National Oceanic and Atmospheric Administration polar satellites. The directional reflectance model derived for the deserts was a function of the sum and product of the cosines of the solar and viewing zenith angles, and thus reciprocity existed between these zenith angles. The emittance model was related by a power law of the cosine of the viewing zenith angle. Author

**N86-23161#** Meteorological Satellite Center, Tokyo (Japan).
**SUMMARY OF OPERATIONAL WIND DERIVATION SYSTEMS USED DURING AND AFTER FGGE PERIOD**
Tadaaki Hamada 1985 202 p In JAPANESE; ENGLISH summary
(ISSN-0388-9653; MSC-TN-12) Avail: NTIS HC A10/MF A01

Topics addressed include operational wind derivation systems used during the First GARP Global Experiment; upper level wind derivation; future satellite systems; orbit generation for polar orbit satellites; utilization of space environment monitor; infrared imaging; visible and infrared spin scan radiometer; sea surface temperatures; and monthly mean cloudiness data. B.G.

**N86-23162#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**ROLE OF ANTARCTICA IN THE CLIMATE OF THE SOUTHERN HEMISPHERE AS REVEALED BY MODELING STUDIES: A BRIEF REVIEW**
Prakki Satyamurti, Vadlamudi Brahmananda Rao, and Yoshihiro Yamazaki Jan. 1986 42 p refs
(INPE-3777-RPE/501) Avail: NTIS HC A03/MF A01

The observed features of climate of Antarctica and the results of climatic simulation are reviewed. Several interesting aspects of the climate of Antarctic region such as the role of topography and the effect of surface thermal inversions are discussed. The deficiencies of the General Circulation Models in simulating the observed features are mentioned. Author

**N86-23163#** Danish Meteorological Inst., Copenhagen.
**OBJECTIVE ANALYSIS OF PRESSURE DESIGNED FOR DETERMINATION OF GEOSTROPHIC WINDS**
Klaus Hedegaard 1985 76 p refs
(DMI-WSR-4; ISBN-897-7478-256-8) Avail: NTIS HC A05/MF A01

The 2-dimensional field of pressure reduced to mean sea level is analyzed by using different bivariate polynomials. Based on data from the gale of November 24, 1981, it is found that an optimum number of degrees of freedom in the polynomial is approx. n/3, n being the number of stations. A large increase in the number of degrees of freedom beyond this value may cause the noise of the pressure data to influence the analysis. Fine agreement is found between the relative windthrow of conifers in the Danish National Forests during the gale, and the areas of the highest geostrophic wind speeds derived from the pressure analysis. Harmonic analysis of an eight year time series of geostrophic winds from Copenhagen displays a clear diurnal cycle in the east-west component, but only a very weak diurnal variation in the north-south component. A detailed analysis shows this to be attributed to the diurnal temperature cycle over Skane in conjunction with the absence of a diurnal temperature cycle over the Baltic. The similar effects from the smaller land and water areas probably cannot be resolved by the analysis, and the observed oscillation of the geostrophic wind thus only reflects the major features of the difference in diurnal temperature cycles over the area. Author

**N86-23164#** Danish Meteorological Inst., Copenhagen.
**THE SURFACE BOUNDARY LAYER WIND SPEED IN RELATION TO SOME EXTERNAL PARAMETERS**

Klaus Hedegaard 1985 71 p refs
(DMI-WSR-5; ISBN-87-7478-257-6) Avail: NTIS HC A04/MF A01

The dependence of the surface wind speed upon different external parameters is studied by use of simple 2-layer models of the planetary boundary layer. With respect to the external stability parameter it is found that the 925 mb level is a better upper reference level than the 850 mb level. Concerning the reference wind speed, the study shows that the analyzed geostrophic wind speed gives a better result than a measured wind speed from the interval 1000 to 1500 m. Effects of baroclinity and instationarity in geostrophic wind speed are also studied. Concerning baroclinity it is found that of the two baroclinity parameters, only the one along the direction of the surface wind has a noticeable influence upon the surface wind speed. The influence of instationarity in geostrophic wind speed is studied by interpolating the geostrophic wind speed Delta t backwards in time. The best results are obtained using delta t = 1 hour, which is in agreement with scale considerations. Author

**N86-23165#** Danish Meteorological Inst., Copenhagen.
**MODELLING OF POLAR LOWS IN A BAROTROPIC ENVIRONMENT USING THE DANISH OPERATIONAL LIMITED AREA MODEL**

Peter Aakjaer and Erik Rasmussen (Copenhagen Univ., Denmark) 1985 51 p refs
(WSR-6; ISBN-87-7478-259-2) Avail: NTIS HC A04/MF A01

By means of an operational numerical Limited Area Model based on the ECMWF global model experiments with high resolution were carried out on polar low developments in a barotropic environment at rest. The vertical structure of the environment was chosen to be typical of cold air outbreaks over the Norwegian and Barents Sea area. An experiment with the fully parameterized model, including air/sea fluxes of latent and sensible heat, shows the development of a warm core polar low of the merry-go-round type, in which the initial low expands and forms smaller vortices embedded in the larger scale flow. The model low is compared to an observed merry-go-round polar low from December 1981. Sensitivity experiments, which show the importance of sensible and latent heat fluxes from the sea surface, are discussed, and some aspects of the precipitation parameterizations are investigated. Experiments with different sea surface temperatures suggest that polar lows do not develop in the area if the temperature is below 4 C. The three-dimensional structure of the fully developed low shows a significant secondary circulation which provides around half the latent heat which subsequently is released by the convection. Author

**N86-23166#** World Meteorological Organization, Geneva (Switzerland).
**CASEBOOK ON OPERATIONAL ASSESSMENT OF AREAL EVAPORATION**

1985 213 p refs
(WMO-635; ISBN-92-63-10635-5; OH-22) Avail: NTIS MF A01; print copy available at WMO, Geneva

Methods to estimate actual evaporation are presented in order to provide users with practical guidance on the subject. Direct measurement and indirect estimation methods are included. For individual titles, see N86-23167 through N86-23181.

**N86-23167#** Atmospheric Environment Service, Downsview (Ontario).
**ESTIMATION OF SHALLOW LAKE EVAPORATION USING CLASS A PAN DATA**

H. L. Ferguson, G. denHartog, and P. Y. T. Louie *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 3-10 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

Evaporation loss from a small lake in the Canadian shield was studied. Standard installations of class A pans were operated at land sites near the lake. A class A pan partially submerged in the lake center was also used in an attempt to obtain direct measurements of lake evaporation loss. A large difference between the estimates from the lake pan and the two shore pans is found. The most likely reason is the sheltering and shading effect of the forest on the shore pans and a wetting and wall evaporation effect on the lake pan, caused by waves rocking the pan. Author (ESA)

**N86-23168#** Egyptian Meteorological Authority, Cairo.
**EVAPORATION FROM THE ASWAN HIGH DAM LAKE (LAKE NASSAR)**

M. H. Omar and M. M. El-Bakry *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 11-15 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

A bulk aerodynamic method was used to measure lake evaporation. A meteorological floating station was installed 1 km upstream of the dam. Dry and wet bulb temperatures were measured by a mechanically aspirated psychrometer kept horizontal at 2 m level. A Lambrecht thermohygrograph and maximum and minimum thermometers were also used. A conversion factor was applied to the coefficients of the Marciano and Harbeck quasi-empirical equation, deduced from the relation of the absolute air temperatures of the two lakes. The accuracy of the evaporation results obtained is 15%. Author (ESA)

**N86-23169#** Geological Survey, Raleigh, N. C.
**APPLICATION OF MASS-TRANSFER THEORY TO DETERMINE NATURAL AND FORCED EVAPORATION FROM HYCO LAKE, NORTH CAROLINA**

G. L. Giese *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 16-31 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

The application of a semiempirical mass transfer technique to determine monthly values of natural and forced evaporation from the lake is described. The lake is a 17.6 million sqm impoundment created by construction of a dam on the Hyco river. An expression derived from Harbeck's mass transfer equation is presented. Meteorological data and local measurements were used. A sample calculation of the net change in lake state adjusted for inflow, outflow, and rainfall is discussed. It is believed that monthly values of natural and forced evaporation from Hyco lake have a standard error of estimation of no more than 10%. Author (ESA)

**N86-23170#** World Meteorological Organization, Geneva (Switzerland).
**DERIVATION OF EVAPOTRANSPIRATION MAPS OF A TROPICAL, HUMID ISLAND**

K. Venkatasawmy (Meteorological Services, Vacoas, Mauritius) *In its* Casebook on Operational Assessment of Areal Evaporation 1985 p 34-43 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

The preparation of an annual potential evaporation map of an island is described. Monthly Penman potential evaporation figures for an open water surface were computed for seven stations. The relation between the Penman estimates and those derived from other formulae was examined. Good correlation exists between Penman's estimates and Turc's formula estimates. Turc estimates were worked out for eight other stations. The comparison of the estimates with class A pan measurements gives a ratio of 0.94 to 1.08. The approximation is also good when compared with lysimeter readings (sugar cane fields). The obtained map is presented.
Author (ESA)

**N86-23171#** Agricultural Research Inst., Nicosia (Cyprus).
**PAN EVAPORATION AS A GUIDE FOR SCHEDULING IRRIGATION**

Chr. Metochis *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 44-49 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

Pan evaporation values are used in combination with predetermined monthly crop coefficients for scheduling irrigation of lucerne.

Comparison of potential evpotranspiration by six methods shows that pan evaporation values gave the best estimates, especially during the hot part of the season. The study was carried out at a farm in the central plains of Cyprus. Calculated potential evotranspiration and pan evaporation, as well as their ratios (crop coefficients) are presented for two irrigation seasons. Lucerne was always under optimum soil-moisture conditions and produced 25400 kg of dry matter per hectare a year. Author (ESA)

**N86-23172#** Meteorological Office, Bracknell (England).
**EVAPORATION CALCULATION SYSTEMS USED IN THE UNITED KINGDOM**
B. G. Wales-Smith and J. A. Arnott *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 50-78 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

An automatic computerized system designed to produce weekly statements and summaries of weather elements with a minimum of human intervention is described. The object is to provide a routine advisory service to the water industry, agriculture, and other interests. The basic input consists of the routine reports from synoptic weather stations. The calculations and software were developed around the United Kingdom climate situation. At the heart of the method lies the evaporation estimate provided by the combination equation of Penman. The interpolation procedures and other algorithms are described. Examples of computation are given. Author (ESA)

**N86-23173#** Institut Royal Meteorologique de Belgique, Brussels. Hydrology Section.
**DAILY EFFECTIVE EVAPOTRANSPIRATION FROM A RIVER BASIN**
F. Bultot and G. L. Dupriez *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 80-105 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

A conceptual model where the only input variables are daily rainfall and potential evapotranspiration is presented. The potential evapotranspiration from the catchment is estimated by the energy-balance method. The first part of the model simulates the daily water balance in the vegatative canopy. Infiltration, runoff, and percolation simulation are also described. A summary of the results given by the model showing the input variables and the three components of the evapotranspiration is presented, including the water storage in the three reservoirs of the model and the intermediate terms of the balance (throughfall, surface runoff, infiltration and percolation). Author (ESA)

**N86-23174#** Institute of Meteorology and Water Management, Warsaw (Poland).
**ESTIMATION OF ACTUAL EVAPOTRANSPIRATION BY MEANS OF A MATHEMATICAL MODEL**
J. Jaworski *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 106-120 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

A quantitative assessment of actual evapotranspiration is performed using a mathematical model which simulates the process and soil-moisture changes. The Fortran program estimates daily or hourly evapotranspiration on an Odra 1305 computer. Parameters and variable data needed are described. The model has three components. The first computes the diffusive crop canopy resistance, the second computes actual evapotranspiration, and the third allows the calculation of soil moisture at the end of the time interval by means of the water balance equations and two fictitious reservoirs. An example of computation is given. It is shown that the model allows a correct quantitative description of actual evapotranspiration for short time intervals. Author (ESA)

**N86-23175#** Geological Survey, Tucson, Ariz.
**EVAPOTRANSPIRATION FROM SALTCEDAR (TAMARIX CHINENSIS)**
T. E. A. vanHylckama *In* WMO Casebook on Operational Assessment of Areal Evaporation 1985 p 121-133 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

A model to determine the amount of water given off to the air by an area covered with a dense stand of saltcedar is explored. It was estimated that saltcedar uses the equivalent of 1200 mm of water per year, which is a large amount in the reference west American areas where annual rainfall is often 400 mm or less. The study was carried out in Arizona. A combination of the mass balance and the energy balance approach of Penman was adopted. Computed results are close enough to measured data to give reliable evapotranspiration for daily or monthly periods, while computing evapotranspiration using averaged data leads to gross errors of $> 30\%$. Author (ESA)

**N86-23176#** Norwegian Hydrodynamic Labs., Trondheim. Div. of River and Harbor Lab.
**COMPUTATION OF MEAN AREAL EVAPOTRANSPIRATION BY THE WATER-BALANCE METHOD**
A. Killingtveit *In* WMO Casebook of Operational Assessment of Areal Evaporation 1985 p 134-142 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

The water budget methodology is reviewed and applied to a case study, the Sagelva hydrological research basin in Norway. The identification of precipitation distribution, the correction of precipitation data, and the areal precipitation computation are described. The accuracy and limitations of the method are discussed. The error analysis shows a total error of 7% where the most critical term is the water precipitation estimation. Author (ESA)

**N86-23177#** Meteorologischer Dienst der DDR, Berlin (East Germany). Research Inst. for Hydrometeorology.
**COMPUTATION OF MONTHLY VALUES OF ACTUAL AREAL EVAPOTRANSPIRATION BY THE COMPLEX USSR METHOD**
E. vonSchoenermark *In* WMO Casebook of Operational Assessment of Areal Evaporation 1985 p 143-148 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

An areal evapotranspiration method based on water balance was tested with data from the Selke catchment area in East Germany. The mathematical expressions include several different types of water storage estimates. The inputs necessary and derivations are discussed. The applications show that the method leads to satisfactory results for lowland and medium altitudes. The method is only suitable for catchment areas with measured runoffs. The case study estimate deviates by only 2 mm from the mean difference between the mean areal precipitation and the mean annual runoff. Author (ESA)

**N86-23178#** Research Inst. for Water Resources Development, Budapest (Hungary).
**ESTIMATION OF EVAPOTRANSPIRATION FROM A WATERSHED**
G. Szabo *In* WMO Casebook of Operational Assessment of Areal Evaporation 1985 p 149-158 refs (For primary document see N86-23166 13-47)
Avail: NTIS MF A01; print copy available at WMO, Geneva

An empirical method utilized for the estimation of the evapotranspiration of Lake Velence in Hungary is described. The aim is to describe the complex vapor transport process using a simple mathematical model and measured values. The method requires the determination of the potential evapotranspiration and the characterization of the vapor supply system (soil and vegetation together) based on the soil water resources available for evaporation and the type of vegetation cover. The empirical mathematical equations are detailed. The collected results are shown, and the variation of evapotranspiration values are discussed. The monthly values error is $< 10\%$. Author (ESA)

**N86-23179#** Arizona Univ., Tucson. School of Renewable Natural Sources.

**BOWEN RATIO ESTIMATES OF WILDLAND EVAPOTRANSPIRATION**

L. W. Gay *In* WMO Casebook of Operational Assessment of Areal Evaporation 1985 p 159-169 refs (For primary document see N86-23166 13-47)

Avail: NTIS MF A01; print copy available at WMO, Geneva

The methodology used to evaluate evapotranspiration by application of an energy budget method is described. The study is part of a larger study designed to test the effectiveness of antitranspirants in reducing evapotranspiration from riparian vegetation. The aim is to compare treated and untreated vegetation areas monitored throughout the day to deduce the effect of the treatments. The measurements extended over a 1 week period during the warm, dry summer of a semiarid south western region of the United States. The Bowen ratio method is a sequential analysis and the data required includes net radiation, change in heat storage in soil and vegetation, air temperature and vapor gradients in the lower atmosphere. The mean water loss according to the Bowen ratio is 8.8 mm, comparable to the mean of 9.15 mm from 2 lysimeters. The two methods are within 2% of their mean. The limitations of the method are discussed. Author (ESA)

**N86-23180#** Research Inst. for Irrigation, Prague (Czechoslovakia).

**DETERMINATION OF EVAPOTRANSPIRATION OF AGRICULTURAL CROPS IN IRRIGATED AREAS OF CZECHOSLOVAKIA**

M. Pycha *In* WMO Casebook of Operational Assessment of Areal Evaporation 1985 p 170-185 refs (For primary document see N86-23166 13-47)

Avail: NTIS MF A01; print copy available at WMO, Geneva

Evapotranspiration of field crops was calculated on the basis of water balance in the soil profile to a depth of 100 cm. The soil humidity was determined by the gravimetric method at 12 depth points once a week. The humidity was determined before and after each irrigation and after a daily precipitation of > or = 10 mm. Water storages were calculated. The ratio of evapotranspiration to the sum of daily values of saturation deficit determines the coefficient of the biological curve of water requirement of crops. The reliability of the estimated values of irrigation water requirements is estimated and the probability curve for exceeding the irrigation requirements is given. Author (ESA)

**N86-23181#** Libyan Arab Jamahiriya, Tripoli. Meteorological Dept.

**POTENTIAL EVAPORATION IN DIFFERENT PARTS OF LIBYA** **c14**

S. E. Hassan *In* WMO Casebook of Operational Assessment of Areal Evaporation 1985 p 186-194 refs (For primary document see N86-23166 13-47)

Avail: NTIS MF A01; print copy available at WMO, Geneva

A method based on the techniques of Penman and Lane was adopted after comparison with six other physical and empirical methods and used for a general survey to compute average potential evaporation from short grass covered surfaces for the period 1960 to 1969. Data analysis shows that the method agrees well with Penman estimates. Class A pan measurements show a slightly larger deviation. Author (ESA)

**N86-23182#** Lawrence Livermore National Lab., Calif.

**BLAST FOCUSING AT AEDC AS A RESULT OF WEATHER CONDITIONS**

B. A. Bowman May 1985 22 p

(Contract W-7405-eng-48)

(DE86-002842; UCID-20570) Avail: NTIS HC A02/MF A01

An assessment is made of the atmospheric focusing hazard associated with an accidental explosion at the Arnold Engineering Development Center near Tullamoma, Tennessee. The SIPS code is used to predict the locations and overpressures of focal points based on average weather data from the Nashville area and for some hypothetical weather profiles. Results indicate that average weather patterns will not result in focusing of the blast wave. DOE

**N86-23183#** National Academy of Sciences - National Research Council, Washington, D. C. Ad Hoc Committee on the Relationship between Land Ice and Sea Level.

**GLACIERS, ICE SHEETS AND SEA LEVEL: EFFECT OF A CO2-INDUCED CLIMATIC CHANGE**

Sep. 1985 345 p Presented at the National Research Council Conference on Ice, Sea Level and A CO/sub 2/-induced Climate Change, Seattle, Wash., 13 Sep. 1984

(Contract DE-FG01-84ER-60235)

(DE86-000722; DOE/ER-60235/1; CONF-8409290) Avail: NTIS HC A15/MF A01

The workshop examined the basic questions of how much water has been exchanged between land ice and ocean during the last century, what is happening now, and, given existing climate-modeling prediction, how much exchange can be expected in the next century. In addition, the evidence for exchange was examined and gaps in that evidence were identified. The report includes the 23 presentations made at the workshop, summarizes the workshop discussion, and presents the Committee's findings and recommendations. Separate abstracts have been prepared for the 23 presentations. DOE

**N86-23184#** World Meteorological Organization, Geneva (Switzerland).

**METEOROLOGICAL SERVICES OF THE WORLD**

1985 367 p refs

(WMO-2; ISBN-92-63-03002-2) Avail: NTIS MF A01; print copy available at WMO, Geneva

For World Meteorological Organization members, details of the state meteorological service; other state meteorological organizations dependent on the service; other state meteorological organizations independent of the service; meteorological institutes forming part of the service; meteorological institutes not forming part of the service; publications; and responsible authority for aeronautical meteorological services are listed. Author (ESA)

**N86-23185#** National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

**PROFILER STANDARD FORMAT FOR DATA EXCHANGE: PROFILER SITE TO HUB COMPUTER**

J. Forberg and M. Barth Sep. 1985 32 p

(PB86-123734; NOAA-TM-ERL-WPL-126) Avail: NTIS HC A03/MF A01 CSCL 04B

The National Oceanic and Atmospheric Administration (NOAA) has established a Wind Profiler Demonstration Project. Its goal is to show that a network of wind Profilers can routinely support agencies such as the National Weather Service under operational conditions. Through the Wave Propagation Laboratory's Profiler Technology Transfer group, NOAA will deploy a network of wind Profilers in the Colorado-Kansas-Oklahoma area. This document describes the formats and content of the data transmitted by this network of Profilers to the central computer. This flexible set of formats will make possible automated exchange of Profiler data generated by this network or any other computer system. GRA

**N86-23186#** Alabama Univ., Dauphin Island. Marine Resources Lab.

**ANALYSIS OF THE WINDS (1974-1984) AND SEA LEVEL ELEVATIONS (1973-1983) IN COASTAL ALABAMA**

W. W. Schroeder and W. J. Wiseman (Louisiana State Univ., Baton Rouge) 1985 112 p Sponsored in part by NOAA, Rockville, Md. and Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Miss.

(Grant NA81AA-D-00050)

(PB86-125515; MASGP-84-024) Avail: NTIS HC A06/MF A01 CSCL 04B

Monthly and annual wind roses, constructed from 10.5 years of data collected on Dauphin Island, Alabama, exhibit a high degree of variability. However, monthly composite roses present a recognizable seasonal pattern; northerly winter winds; easterly to southerly spring winds; southerly to westerly and back to easterly winds in the summer; and in the fall a return to north-easterly and northerly winds. Mean monthly wind speeds ranged from a high

of 8.1 k in January to a low of 5.2 kin in July. On a directional interval basis the highest mean speed 9.5 k, occurred during northerly winds while the lowest mean speed, 4.9 k, occurred during westerly winds. Sustained wind speeds of 30 k or greater were recorded during tropical cyclones, a winter cold front storm and a thunderstorm. GRA

**N86-23187#** National Severe Storms Forecast Center, Kansas City, Mo.
**VERIFICATION OF SEVERE LOCAL STORM FORECASTS ISSUED BY THE NATIONAL SEVERE STORMS FORECAST CENTER, 1984 Final Report**
P. W. Leftwich Nov. 1985 16 p
(PB86-128105; NOAA-TM-NWS-NSSFC-9) Avail: NTIS HC A02/MF A01 CSCL 04B

The SELS Unit of the National Severe Storms Forecast Center routinely issues convective outlooks and severe local storm watches that delineates areas that are favorable for development of severe local storms. This report summarizes verification of those forecasts that were issued during 1984. Convective outlooks benefitted from later diagnostic analysis and additional numerical guidance. The highest degree of forecast skill was observed during the active months of spring. Skill in distinguishing the added threat of tornadoes in tornado watches was observed. High percentages of tornado-related fatalities (87%) and injuries (88%) were covered by valid severe local storm watches. GRA

**N86-23188#** National Weather Service, Silver Spring, Md. Techniques Development Lab.
**APPLICATION OF CUMULUS MODELS TO MOS (MODEL OUTPUT STATISTICS) FORECASTS OF CONVECTIVE WEATHER**
D. H. Kitzmiller Jun. 1985 58 p
(PB86-136686; NOAA-TM-NWS-TDL-76) Avail: NTIS HC A04/MF A01 CSCL 04B

The National Weather Service currently issues twice-daily forecasts of thunderstorm and severe local storm probability based on Model Output Statistics. The probability forecasts are given by a weighted linear combination of meteorological predictors derived from NMC's limited-area fine mesh (LFM) model and TDL's three-dimensional trajectory models. In an effort to improve the resolution of forecasts, new predictors deprived from models of cumulus dynamics and thermodynamics have been developed and tested. A multiple linear screening regression procedure was used to derive new probability equations that utilize both the experimental and operational predictors. Author (GRA)

**N86-23189#** National Weather Service, Salt Lake City, Utah.
**HEMISPHERIC SPECTRAL WAVE ANALYSIS (WAVES 0 TO 7)**
M. F. Milkovich Aug. 1985 47 p
(PB86-108719; NOAA-NWS-WRCP-49) Avail: NTIS HC A03/MF A01 CSCL 04B

This program performs a spectral analysis of 500 mb heights from hemispheric analyses and Medium Range Forecast (MRF) model data as received on AFOS. Wave energy amplitudes and wave phases are calculated over seven latitude circles (35N-55N) for waves 0 to 7. The program also chains to a graphics program which calculated phase speeds for waves 0 to 7 and produces an AFOS graphic depicting wave amplitudes and phase speeds. Both programs are designed to run on the Data General AOS system only. GRA

**N86-23190#** National Environmental Satellite Service, Washington, D. C.
**MARINERS WEATHER LOG, VOLUME 29, NUMBER 3, SUMMER, 1985**
1985 67 p
(PB86-113925) Avail: NTIS HC A04/MF A01 CSCL 04B

The Mariners Weather Log, Volume 29, No. 3, Summer 1985, reports on the following topics: under the Bangladesh cyclone; marine observations program; tips to the radio officer; the editor's desk; marine weather review. GRA

**N86-23191#** National Weather Service, Salt Lake City, Utah.
**GREAT SALT LAKE EFFECT SNOWFALL: SOME NOTES AND AN EXAMPLE**
D. M. Carpenter Oct. 1985 25 p
(PB86-119153; NOAA-TM-NWS-WR-190) Avail: NTIS HC A02/MF A01 CSCL 04B

A lake effect snowfall along the Wasatch Front is typically a post cold frontal event in which the duration of snowfall downwind of the lee shore is extended in cold, northwest flow. The paper is based on data taken from lake effect cases that occurred in the northwest flow following the passage of an upper level trough. Occasionally it appears that a lake effect may have occurred in southwest flow, which enhances or produces snowfall close to the northeast shoreline. The necessity of a rapid infusion of cold air, usually in the form of a cold pocket, and the fact that this air would have to come from a southerly direction makes a conventional lake effect hard to come by. Even after limiting the study to storms that occur in northwest flow, the effect of the Great Salt Lake on snowfalls is not one that can be easily measured. Author (GRA)

**N86-23192#** National Weather Service, Garden City, N.Y.
**FPCPLT:MOS TEMPERATURE AND PROBABILITY OF PRECIPITATION FORECAST PLOT**
W. C. Randel Oct. 1985 26 p
(PB86-120029; NOAA-NWS-ERCP-34) Avail: NTIS HC A03/MF A01 CSCL 04B

The program generates an AFOS plot of the MOS 12 hour - 4 period temperature and probability of precipitation (PoPS) forecasts from the AFOS cccFPCxxx product. Several stations can be plotted on one graphic. Frequently the forecasters in Cleveland would hand plot the MOS temperature and PoP forecasts for stations in and near the state to obtain a single display of the temperature and PoP forecasts. The data was obtained by displaying the eight AFOS graphic charts containing the temperature and PoP forecasts. FPCPLT automates this. GRA

**N86-23193#** National Weather Service, Fort Worth, Tex.
**AUTOMATED PROCEDURE FOR COMPOSITION OF SEVERE WEATHER WATCH AREAL REDEFINING STATEMENTS Revised**
G. A. Hammons Sep. 1985 23 p
(PB86-120730; NOAA-TM-NWS-SR-100) Avail: NTIS HC A02/MF A01 CSCL 04B

Current National Weather Service (NWS) policy requires that when a Tornado or Severe Thunderstorm Watch (commonly referred to as a box) is issued by the National Severe Storms Forecast Center (NSSFC), each affected State Relay Center must issue a Redefining Statement (Areal Outline) describing the part of the state included in the Watch area. It is released to the public and is usually expressed in terms of whole counties, cities, or well-known geographical landmarks. Forecasters previously plotted the watch area on a map, then determined the affected counties visually. This procedure is relatively time-consuming, usually is done under some pressure at unscheduled times, and is subject to various errors. The Scientific Services Division of the Southern Region developed a FORTRAN program (REDEFINE) to produce the Redefining Statement automatically on AFOS, given only the size and orientation of the SELS watch box and the issue time. This memo decribes the program and its use, as well as changes to the program made since the original issuance in 1979. GRA

**N86-23194#** National Weather Service, Fort Worth, Tex.
**FLORIDA EAST COAST THANKSGIVING HOLIDAY STORM OF 1984**
B. Sylvern, C. Brock, F. Gonzales, and R. Biedinger Sep. 1985 27 p
(PB86-120748; NOAA-TM-NWS-SR-113) Avail: NTIS HC A03/MF A01 CSCL 04B

During the period November 21 through 24, 1984, a low pressure system formed over the Atlantic Ocean near the southeast Florida coast and developed into an intense storm, unusually strong

and well defined for this area and season. The storm produced extensive damage, widespread coastal flooding and severe beach erosion along the Florida Atlantic coast from West Palm Beach northward to Fernandina Beach. A strong high pressure area over the northeast U.S. enhanced the severity of the storm.
Author (GRA)

**N86-23195#** National Weather Service, Washington, D.C. Climate Analysis Center.
**MONTHLY AND SEASONAL WEATHER OUTLOOK FOR MID-OCTOBER TO MID-NOVEMBER, 1985, VOLUME 39, NUMBER 20, OCTOBER 15, 1985**
15 Oct. 1985 10 p
(PB86-121183) Avail: NTIS HC A02/MF A01 CSCL 04B
The report gives temperature and precipitation probabilities for the monthly and seasonal weather for North America for the period mid-October to mid-November 1985. GRA

**N86-23196#** National Weather Service, Washington, D.C. Climate Analysis Center.
**MONTHLY AND SEASONAL WEATHER OUTLOOK FOR NOVEMBER 1985, VOLUME 39, NUMBER 21, OCTOBER 30, 1985**
30 Oct. 1985 17 p
(PB86-121191) Avail: NTIS HC A02/MF A01 CSCL 04B
The report gives temperature and precipitation probabilities for the monthly and seasonal weather for North America for November 1985. GRA

**N86-23197#** National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
**FIELD MEASUREMENTS IN THREE DIMENSIONS OF PLUME DISPERSION IN THE HIGHLY CONVECTIVE BOUNDARY LAYER**
W. L. Eberhard, W. R. Moninger, T. E. Uttal, S. W. Troxel, and J. E. Gaynor Oct. 1985 8 p
(PB86-121472; EPA-600/D-85-232) Avail: NTIS HC A02/MF A01 CSCL 04B
Previous laboratory experiments and numerical modeling have identified characteristics of plume dispersion in the highly convective mixed layer that deviate significantly from predictions of Gaussian models. To assess the validity of these observations, meteorologists conducted a field study named CONDORS (Convective Dispersion Observed with Remote Sensors). CONDORS demonstrated that radar measurements of chaff under convective conditions and lidar measurements of oil fog can succeed in describing not only general plume location and shape, but also relative tracer concentrations. With sufficient care in tracer generation, sensor operation, and signal processing, the tracer systems are semiconservative and losses that do occur can be reasonably balanced. GRA

**N86-23198#** Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
**RESEARCH ON DIFFUSION IN ATMOSPHERIC BOUNDARY LAYERS: A POSITION PAPER ON STATUS AND NEEDS**
G. A. Briggs and F. S. Binkowski Nov. 1985 250 p
(PB86-122587; EPA-600/3-85-072) Avail: NTIS HC A11/MF A01 CSCL 04B
The introduction of a new understanding of atmospheric boundary layers (ABLs) has caused a major change in the view of the diffusion of pollutants. The turbulence parameters now standard in AFL work, have provided a method for systematically organizing diffusion parameters. Concurrently with these advances, alternatives to the operational models have emerged, but existing experimental data sets are inadequate for model comparisons and evaluations. The most important knowledge gap is the lack of an adequate specification of the relevant meteorology both at the point of release and downwind. A second major inadequacy is experimental measurements of plume characteristics up to 100 km from the release point. There is also a great need for formulating new operational based models upon this newly acquired experimental data and the new alternative approaches. Finally, it is recognized that a modest but steady effort is necessary. GRA

**N86-23023#** Joint Publications Research Service, Arlington, Va.
**HYDROCHEMICAL INDICATORS OF FRONTAL CYCLONIC EDDY IN ANTARCTIC CIRCUMPOLAR CURRENT Abstract Only**
A. M. Chernyakova and S. O. Bordokin *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 41 Transl. into ENGLISH from Okeanologiya (Moscow, USSR), v. 25, no. 5, Sep. - Oct. 1985 p 740-743 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

# 48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

**N86-23199** California Univ., San Diego.
**LABORATORY STUDIES OF INTERNAL GRAVITY WAVE CRITICAL LAYERS Ph.D. Thesis**
Donald Brent Altman 1985 158 p
Avail: Univ. Microfilms Order No. DA8524561
A study of internal wave critical layers in accelerating mean flows is described. Alternatively this can be viewed as a study of stratified accelerating shear flows over topography. The work consists of three main parts: the development of an automated image processing system for the reading of streak photographs, the performance of a series of experiments on two-layer flows, and the performance of experiments on continuously-stratified flows. The image processing system is a collection of menu-driven FORTRAN programs that produce calibrated velocity measurements from a digitized particle-streak photograph. Operations include processing and filtering at the pixel level, automatic streak identification and connection, processing and filtering at the streak level, geometrical corrections and calibration, and the calculation of wavelength-averaged, depth-dependent flow measurements. The system is comparable to, or faster than, all other fluid-mechanics image processing systems examined. In the two-layer flow experiments, acceleration of the mean flow has been found to create a new scenario for instability. Dissert. Abstr.

**N86-23200** Delaware Univ., Newark.
**DIRECTIONAL WAVEMAKER: THEORY AND EXPERIMENT Ph.D. Thesis**
Yung-Chao Wu 1985 169 p
Avail: Univ. Microfilms Order No. DA8525295
The three-dimensional structure of linear and nonlinear waves generated by infinite length and the finite length three-dimensional wavemakers is developed theoretically. The analytic solution of the wave field generated by a finite length wavemaker is very complex, therefore, a parabolic model is introduced to solve this problem. A three-dimensional wavemaker can exist only in theory. To generate directional waves in a wave tank, we use a multi-element wavemaker; therefore, the multi-element wavemaker theory and the relation between three-dimensional wavemaker and multi-element wavemaker is presented. The effect due to the finite length of elements (paddles) was examined theoretically. A wavemaker moving in simple-harmonic motion produces wave trains both at the frequency of the wavemaker and its harmonics. These waves consist of the Stokes waves as well as higher harmonic free waves due to the finite displacement of the paddles; a physical model was used at the Ocean Engineering Laboratory in the University of Delaware to detect the waves by the techniques of the wavenumber-frequency spectral analysis.
Dissert. Abstr.

**N86-23201#** Defence Research Information Centre, Orpington (England).
**BIOLUMINESCENCE OF THE SEA**
Aug. 1985 102 p refs Transl. into ENGLISH of the book "Bioluminescence of the Sea', Moscow, Nauka Publishers, p 40-67, 83-89, 126-152 and 160-171

(DRIC-T-7565; BR97393) Avail: NTIS HC A06/MF A01

The biological characteristics of the luminescence of marine bioluminescents are reviewed. Luminescence stimulation and the flash characteristics of individual organisms are considered. Laboratory techniques and procedures for measurement of bioluminescence in marine organisms are detailed, and instruments for the investigation of marine bioluminescence in situ are described. Geographical and vertical distribution of bioluminescence, including measurement and processing methods, and the effects of diurnal rhythms and migrations are discussed. Author (ESA)

**N86-23202** Defence Research Information Centre, Orpington (England).

**OCCURENCE OF EDDY FORMATION IN WIND-GENERATED WAVE PATTERN**

V. A. Dulov, V. N. Kudryavtsev, and V. V. Malinovsky Oct. 1985 20 p refs Transl. into ENGLISH from Morskoi GGidrofizicheskii Zhurnal (USSR), vol. 2, 1985 p 44-52

(DRIC-T-7593; BR97523) Copyright. Avail: Issuing Activity

The influence of surface currents accompanying eddy formation on wind-generated ocean waves is analyzed. The kinematics and dynamics of waves in the eddy field are considered. Foam-covered sea surface fraction variations are evaluated. It is concluded that eddy formations with radii on the order of 10 km can occur in the distribution pattern of wind-generated wave parameters which may be remotely sensed by radiometry or radar. Author (ESA)

**N86-23203#** Naval Ocean Research and Development Activity, Bay St. Louis, Miss.

**PROCEEDINGS OF THE ARCTIC OCEANOGRAPHY CONFERENCE AND WORKSHOP HELD AT THE NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY, NSTL, MS. ON JUNE 11-14, 1985**

1985 293 p Conference held in Bay St. Louis, Miss., 11-14 Jun. 1985

(AD-A162578) Avail: NTIS HC A13/MF A01 CSCL 20/1

The four general subject areas were: Arctic Operations and acoustics; Buoys; and Sea Ice. Included titles are: MIZEX(Marginal Ice Zone Experiment) Operations; International Ice Patrol Operations; Remote Sensing for Polar Icebreaker Navigation in Sea Ice; Satellite Telemetry Buoys for Collection of Arctic Acoustic and Environmental Data; Arctic Temperature - Conductivity Buoys; Generation and Movement of Ice Islands near the Canadian Arctic Archipelago; Effect of the Physical Properties of Ice on the High Frequency Acoustic Backscatter from an Ice Keel Model; Simulation Model for High-Frequency Underice Acoustic Backscattering; High Frequency Acoustic Reflection from Flat Sea Ice; Use of Penetrators to Estimate the Properties of Ice in Arctic Regions; Acoustic Bottom Interaction Considerations in the Arctic; Horizontal Directionality of Ice Edge Noise; Characteristics of Industrial Sounds in the Shallow Beaufort Sea; A Multi-bounce, Single-scatter, Ray Theoretic Model for Under-ice Predictions, Frequency-domain Electromagnetic Ice-sounding; Radiometric Imagery of Sea Ice; Remote Sensing of the Marginal Ice Zone During MIZEX 83 and 84; Variations in Bering Sea Ice Coverage Related to Large-scale Atmospheric Circulation Patterns; Determining Sea Ice Type and Inferred Ice Thickness Distributions from Aerial Photographs; Pressure Ridge Morphology and Physical Properties of Sea Ice in the Greenland Sea. GRA

**N86-23204#** Miami Univ., Fla. Div. of Meteorology and Physical Oceanography.

**MEASUREMENT OF GULF STREAM AND WIND INDUCED SHELF CIRCULATION IN THE SOUTH ATLANTIC BIGHT Final Report, 1 Jun. 1982 - May 31,1985**

T. N. Lee Jan. 1985 32 p

(Contract DE-AS05-76EV-05163)

(DE86-002786; DOE/EV-05163/T1) Avail: NTIS HC A03/MF A01

The report discusses a study to determine the relative importance of the forces driving shelf circulation and exchange in the South Atlantic Bight and to measure the shelf waters' response over variable time and space scales. Results indicate the outer shelf is controlled by Gulf Stream frontal disturbances such as wave-like meanders and eddy motions, the midshelf by local wind forcing with occasional Gulf Stream intrusions and density induced motions, and the inner shelf by density effects from fresh water river runoff. DOE

**N86-23205#** Institute of Oceanographic Sciences, Wormley (England).

**A LONG-RANGE SIDE-SCAN SONAR SURVEY OF THE MERIADZEK TERRACE, BAY OF BISCAY**

N. H. Kenyon and P. M. Hunter 1985 17 p refs Sponsored by British Telecom

(IOS-210) Avail: NTIS HC A02/MF A01

The Geological Long Range Inclined Asdic (GLORIA) mapped the Bay of Biscay in an area destined for a transatlantic fiber optic cable. Strongly-reflective areas correspond to slopes > 10 deg. It is suspected that backscattering of sound from these slopes is due to their being free of the cover of mud that is usually found on the continental slope and in the deep ocean. These strongly reflective areas ought to be avoided. The Upper and Lower Meriadzek Terrace has gentle slopes, free from large obstacles. However, boulders or wrecks, although unlikely to be present, are too small to be resolved by GLORIA. The Terrace narrows upslope to a neck of only 4 km at a depth of 300 m. The sediment type along the planned route is little known. It is suspected that medium-sized sands will give way to muddy sand and mud at depths between 200 m and 500 m. Author (ESA)

**N86-23206#** Institute of Oceanographic Sciences, Wormley (England).

**THE DISTRIBUTION OF GLACIAL ERRATICS IN THE NORTHEAST ATLANTIC Final Report**

Quentin Huggett 1985 99 p refs

(IOS-213; DoE/RW/85/056; DGR-481/179) Avail: NTIS HC A05/MF A01

Information on glacial erratics, including examination of 288 dredge hauls, 1164 sediment cores, and 176 camera runs is summarized. Sufficient data are collected to estimate the impact risk of a point projectile with a glacial erratic, down to oxygen isotope stage 5 (127,000 yr) in 3 areas of the NE Atlantic: Porcupine seabight = 0.460%; King's Trough Flank = 0.502%; Great Meteor East = 0.015%. The estimates are for all erratics > 1.5 cm diameter and apply only down to oxygen isotope stage 5. Author (ESA)

**N86-23207#** Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

**STRATEGIES FOR THE CALIBRATION AND OPERATIONAL USE OF THE ERS-1 SAR WAVE MODE Final Report**

Andrew D. Goldfinger Paris ESA Mar. 1985 126 p refs Original contains color illustrations

(Contract ESTEC-5538/83)

(JHU/APL/SDO-7565; ESA-CR(P)-2097) Avail: NTIS HC A07/MF A01

Algorithms for estimating ocean wave spectra and tracking spectral peaks for ERS-1 Active Microwave instrument were studied. Procedures for calibrating the system and validating the algorithms are proposed. The ocean can be represented by a two-scale model in which random local phenomena cause small uncorrelated variations in the ocean spectrum that are superimposed on slowly changing excursions due to macroscopic effects. Macroscopic phenomena show correlation lengths of 50 to 100 km. Principal error sources in measuring spectral peak positions are: error inherent in measuring a static spectral peak; error due to dynamic tracking effects; and error due to localized ocean excursions. Two bit quantization of the SAR signals is not a significant error source. Spectra should be estimated from multilook imagery. If the number of looks is maximized, it does not matter how the fixed buffer of SAR data is broken up into subimages. Author (ESA)

**N86-23208#** National Science Foundation, Washington, D.C. Div. of Polar Programs.
**ICE SHELVES OF ANTARCTICA**
N. I. Barkov 1985 272 p Transl. into ENGLISH from the mono. "Shelfove Ledniki Antarktidy" Leningrad, USSR, Gidrometeorologicheskoe, 1971
(PB86-106986; TT-75-52081) Avail: NTIS HC A12/MF A01 CSCL 08L

The vast areas occupied by ice shelves and their peripheral location in Antarctica have attracted the attention of investigators for long. Their special features have been studied and their role in the mass budget of the continent's ice cover examined. Information on the ice shelves, published till 1968, has been examined in the monograph. The author describes the special conditions of existence of ice shelves, their movement, morphology, charging, the structure of the thermal regime, and their contribution to the development of glaciation on the continent. In this respect, particular attention has been paid to the study of the floating, most representative, part of such ice formations. GRA

**N86-23209#** National Science Foundation, Washington, D.C. Div. of Polar Programs.
**PROBLEMS OF THE ARCTIC AND THE ANTARCTIC, COLLECTION OF ARTICLES, VOLUME 56, 1981**
A. F. Treshnikov [1985] 167 p Transl. into ENGLISH of Problemy Arktiki i Antarktiki (USSR), Sbornik Statei, v. 56, 1981 p 1-159
(PB86-107109; TT-82-00-102) Avail: NTIS HC A08/MF A01 CSCL 08C

Many articles included in this volume deal with various aspects of the studies on sea ice, viz., conditions of regelation, thermal displacement, deformation and stresses, hummocking, morphology, and techniques of thickness measurements. Another group of articles deals with hydrometeorological forecasts, subsurface currents, water density fields, etc. GRA

**N86-23210#** Science Applications International Corp., McLean, Va.
**UPPER OCEAN AND STRATIFICATION AND VARIABILITY IN THE NORTH ATLANTIC Technical Report, 8 Nov. 1982 - 31 Dec. 1984**
R. B. Lambert and G. T. Hebenstreit May 1985 70 p
(Contract N00014-83-C-0057)
(PB86-110236; SAIC-84/1778) Avail: NTIS HC A04/MF A01 CSCL 08C

Upper ocean temperature data from Ocean Weather Station I are analyzed for variability of time scales from two weeks to ten years. Concurrent meteorological measurements were analyzed as forcing mechanisms, to which the ocean response could be compared. The dominant time scales of meteorological forcing were the annual and diurnal cycles of heating and cooling, and a proannounced five-day period associated with the passage of local weather systems. The dominant time scales of ocean variability were the annual cycle of near-surface stratification, interannual modifications of the annual cycle, and a one to three month period, probability attributable to mesoscale circulation features. A comparison of heat content of the upper 125 meters with the total heat flux led to the conclusion that lateral advection is a dominant process, at least over time scales less than a year. GRA

**N86-23211#** National Environmental Satellite Service, Washington, D. C.
**ENVIRONMENTAL DATA SOURCES FOR THE CHESAPEAKE BAY AREA**
Jun. 1985 66 p
(PB86-110640; NESDIS-ENVIRON-INVENT-3) Avail: NTIS HC A04/MF A01 CSCL 08C

Chesapeake Bay is one of the largest and most productive estuaries in the world. It is a unique, irreplaceable natural--as well as national--resource. Declining harvests of fish and shellfish, however, have served notice that the Bay's renewable living resources are endangered by deteriorating water quality and habitat destruction. The primary purpose of this publication is to provide information about environmental data for the Chesapeake Bay area that is available from the National Environmental Satellite, Data, and Information Service. GRA

**N86-23212#** National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Environmental Research Lab.
**LAKE SUPERIOR COOLING SEASON TEMPERATURE CLIMATOLOGY**
R. A. Assel Mar. 1985 54 p
(PB86-110624; NOAA-TM-ERL-GLERL-58) Avail: NTIS HC A04/MF A01 CSCL 08G

A temperature climatology has been developed for the surface and ten 10-m layers along the normal ship route between the eastern and western ends of Lake Superior and for discrete areas along the ship route. Base period for the climatology includes winters 1973 to 1976 and falls 1976 to 1979. Daily average temperatures and extreme temperatures for the base period were calculated, and a six-wave Fourier equation fitted to the average temperature time series to define the temperature climatology. GRA

**N86-23213#** National Oceanic and Atmospheric Administration, Miami, Fla. Oceanographic and Meteorological Labs.
**HEAT BUDGET AND CLIMATIC ATLAS OF THE EQUATORIAL ATLANTIC OCEAN DURING FGGE (FIRST GARP GLOBAL EXPERIMENT, 1979**
E. Marmoiejo, J. F. Festa, and R. L. Molinan Aug. 1985 82 p
(PB86-111622; NOAA-TM-ERL-AOML-61) Avail: NTIS HC A05/MF A01 CSCL 08J

Observations of surface oceanographic and meteorological fields collected during the first GARP Global Experiment (FGGE) in the equatorial Atlantic Ocean have been combined and averaged by month onto a 2 degree by 2 degree grid. Monthly distributions of sea-surface temperature, wind speed and direction, air temperature, specific humidity, and cloud cover have been generated for the period from December 1978 through November 1979. Net short-wave and long-wave radiation, and sensible and latent heat flux distributions have been generated from surface data using the bulk aerodynamic formulas. Standard errors of the mean values have been computed along with monthly contoured plots of each oceanographic and meteorological variable. GRA

**N86-23214#** Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Miss.
**POLLUTANT TRANSPORT IN MISSISSIPPI SOUND Final Report**
T. F. Lytle and J. S. Lytle Jul. 1985 127 p refs Sponsored in part by Mississippi Bureau of Pollution Control, Jackson, Miss.
(Grants NA79AA-D-0049; NA80AA-D-00017)
(PB86-123809; MASGP-82-038) Avail: NTIS HC A07/MF A01 CSCL 08A

Pollution transport in the Mississippi Sound is reported. The following items are examined: (1) types of samples and analysis selection; (2) sample collection and analysis scheme; (3) pollutant distribution; (4) quantitative pollutant assessment; (5) environmental stress index; (6) use of scientific information. GRA

**N86-23215#** National Center for Atmospheric Research, Boulder, Colo.
**CENOZOIC ORGANIC CARBON DEPOSITION IN THE DEEP SEA M.S. Thesis**
J. L. Sloan 1985 211 p Sponsored in part by the National Science Foundation, Washington, D.C. Prepared in cooperation with Miami Univ., Fla.
(PB86-115524; NCAR/CT-89) Avail: NTIS HC A10/MF A01 CSCL 08A

Lithologic data and physical properties measurements for the sediment recovered by the Deep Sea Drilling Project (Legs 1-79), and age-depth relationships for each drill hole were used to study the Cenozoic world ocean in terms of: (1) the controls on the deposition and preservation of organic carbon in the deep sea, (2) the evidence for variation in average organic carbon accumulation rate, and (3) the flux of organic carbon to three major deposition environments of the deep sea. Results show that: (1) the pattern

of variation in organic carbon content with respect to bulk sediment accumulation rate for ancient marine sediments differs from that for recently deposited marine sediments; (2) the trends in average organic carbon accumulation rate with time are damped in comparison to previously determined trends in organic carbon sedimentation rate. GRA

**N86-23216#** National Oceanic and Atmospheric Administration, Miami, Fla. Oceanographic and Meteorological Labs.
**PEGASUS CURRENT PROFILER MEASUREMENTS COLLECTED FOR EPOCS (EQUATORIAL PACIFIC OCEAN CLIMATE STUDIES), 1980 - 1983**
D. Wilson, C. Roffer, and G. Thomas Aug. 1985 184 p
(PB86-113446; NOAA-DR-ERL-AOML-6) Avail: NTIS HC A09/MF A01 CSCL 08C

Current velocity profiles recorded on nine AOML EPOCS (Equatorial Pacific Ocean Climate Studies) cruises during 1980 to 1983 using the Pegasus profiler are presented. The data were collected along several equatorial transects from 85 W to 110 W. Station locations and current profiles are shown for each cruise; the instrument and techniques of data acquisition and processing are also described. GRA

**N86-23020#** Joint Publications Research Service, Arlington, Va.
**NEW DATA ON DEEP STRUCTURE OF MID-ATLANTIC RIDGE AT 20 DEG S Abstract Only**
Yu. M. Pushcharovskiy, I. N. Yelynikov, and A. S. Perfilyev *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 21 Transl. into ENGLISH from Geotektonika (Moscow, USSR), no. 5, Sep. - Oct. 1985 p 5-13 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

**N86-23021#** Joint Publications Research Service, Arlington, Va.
**HYDROCARBON GAS-HYDRATE FORMATION BENEATH BOTTOM OF SEAS AND OCEANS Abstract Only**
V. Ya. Trotsyuk and I. A. Nemirovskaya *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 27 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), vol. 284, no. 4, Oct. 1985 p 976-978 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

**N86-23022#** Joint Publications Research Service, Arlington, Va.
**NORTH ATLANTIC UPER MANTLE HETEROGENEITIES Abstract Only**
N. Ya. Kunin and S. V. Usenko *In its* USSR Report: Earth Sciences (JPRS-UES-86-004) 31 Mar. 1986 p 31 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 9, Sep. 1985 p 23-35 (For primary document see N86-23017 13-42)
Avail: NTIS HC A04/MF A01

# 51 LIFE SCIENCES (GENERAL)

Includes genetics.

**N86-23217** Defence Research Information Centre, Orpington (England).
**DEMONSTRATION AND ROLE OF CHEMORECEPTION IN THE MARINE ZOOPLANKTON**
S.-A. Poulet Jan. 1985 31 p refs Transl. into ENGLISH from Oceanis, vol. 10, no. 2, 1984 p 131-149
(DRIC-T-7456; BR94716) Copyright. HC A03/MF A01

Information on chemoreception in zooplankton is reviewed. Examples which suggest that chemoreception is responsible for the survival of plankton organisms by regulating reproduction, locomotion, and nutrition are discussed. Author (ESA)

**N86-23218*#** Management and Technical Services Co., Washington, D.C.
**USSR SPACE LIFE SCIENCES DIGEST, ISSUE 4 Final Report**
Lydia Razran Hooke, ed., Mike Radtke, ed., Victoria Garshnek, ed., Ronald Teeter, ed., and Joseph E. Rowe, ed. Feb. 1986 118 p refs
(Contract NASw-3676)
(NASA-CR-3922(04); NAS 1.26:3922(04)) Avail: NTIS HC A06/MF A01 CSCL 06C

The fourth issue of NASA's USSR Space Life Science Digest includes abstracts for 42 Soviet periodical articles in 20 areas of aerospace medicine and space biology and published in Russian during the last third of 1985. Selected articles are illustrated with figures and tables from the original. In addition, translated introductions and tables of contents for 17 Russian books on 12 topics related to NASA's life science concerns are presented. Areas covered are: adaptation, biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, cytology, developmental biology, endocrinology, exobiology, habitability and environmental effects, health and medical treatment, hematology, histology, human performance, immunology, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, perception, personnel selection, psychology, and radiobiology. Two book reviews translated from the Russian are included and lists of additional relevant titles available in English with pertinent ordering information are given. Author

**N86-23219#** Yale Univ., New Haven, Conn.
**USE OF MEMBRANE VESICLES AS A SIMPLIFIED SYSTEM FOR STUDYING TRANSPORT OF AUXIN Progress Report**
M. H. Goldsmith 1985 2 p refs
(Contract DE-FG02-85ER-13337)
(DE86-002264; DOE/ER-13337/1) Avail: NTIS HC A02/MF A01

The accumulation of indoleacetic acid (IAA) inside microsomal vesicles depends on the presence of a pH gradient and is reversible when the (DELTA)pH is collapsed by ionosphores. Accumulation is stimulated by either napthylphthalamic acid or TIBA. The accumulation of IAA by the vesicles can be saturated. At concentrations of 1 microns or less, IAA, synthetic auxins, or auxin antagonists do not affect the pH gradient, but decrease the accumulation of (3)H-IAA, and therefore compete specifically for uptake. Concentrations of 10 microns and above, uptake of either the auxins or weak acids is sufficient to overcome the buffering capacity of the solution within the vesicles. The collapse of the pH gradient by such high concentrations affects uptake of either (3)H-IAA or (14)C-BA to similar extents and thus is nonspecific. DOE

**N86-23220#** Department of Energy, Washington, D. C.
**ANNUAL REPORT AND SUMMARIES OF FY 1985 ACTIVITIES SUPPORTED BY THE DIVISION OF BIOLOGICAL ENERGY RESEARCH**
Nov. 1985 48 p
(DE85-009132; DOE/ER-0147/3) Avail: NTIS HC A03/MF A01

The Biological Energy Research (BER) program of the Office of future energy-related biotechnologies are discussed. The study of green plants as producers of renewable resources is a key aspect of the program. Plant productivity encompasses a broad array of processes, integrated to form a complex whole, the producing plant. Another major aspect of the research program examines microbiological conversions that yield fuels and/or chemicals. These bioconversion processes can provide a substitute for fossil energy resources directly or through energy conserving measures in which biological mechanisms displace industrial energy input requirements (e.g., biological nitrogen fixation, recovery of key resources from dilute concentrations, and conversion of noxious waste products to usable materials [carbon monoxide to organic acids]). In each instance, the research is aimed at understanding the fundamental mechanisms of conversion rather than a description or optimization of a process. One hundred twenty-five projects are described with subject and investigator indexes. DOE

**N86-23221#** Southwest Research Inst., San Antonio, Tex.
**EFFECTS OF 60 Hz ELECTRIC FIELDS ON OPERANT AND SOCIAL STRESS BEHAVIORS OF NONHUMAN PRIMATES**

**Annual Report, 5 Aug. 1984 - 25 Oct. 1985**
W. R. Rogers, J. H. Lucas, G. T. Moore, and J. L. Orr 1985 51 p
(Contract DE-AC02-80RA-50219)
(DE86-002587; DOE/RA-50219/T6) Avail: NTIS HC A04/MF A01

Operant behavioral methods have been used to assess the aversiveness of intense electric fields. One aspect of the aversiveness of a stimulus is the ability to act as a negative reinforcer. A negative reinforcer is a stimulus whose response contingent termination maintains behavior. Baboons were trained to perform an operant task to obtain food rewards, determined that the addition of an intense electric field did not disrupt performance, measured the background level of responding in the absence of any primary reinforcers, assessed the ability of electric field termination to maintain operant responding, and verified that the electric field could serve as a discriminative stimulus. DOE

**N86-23222#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES**
8 Jan. 1986 119 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UBB-86-002) Avail: NTIS HC A06

Research and development in Soviet life, biomedical, and behavioral sciences is reported. The different categories presented include: agrotechnology, biochemistry, biophysics, biotechnology, epidemiology, food technology, genetics, human factors engineering, imunology, marine mammals, medicine, microbiology, molecular biology, pharmacology and toxicology, physiology, public health, veterinary medicine, and virology. For individual titles, see N86-23223 through N86-23257.

**N86-23223#** Joint Publications Research Service, Arlington, Va.
**BIOCHEMICAL MODELS FOR STUDY OF NERVE CELL PROCESSES**
*In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 2 Transl. into ENGLISH from Meditsinskaya Gazeta (Moscow, USSR), 18 Sep. 1985 p 3 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Biochemical models for the study of nerve cells were developed to obtain knowledge of the human brain. Neurochemistry studies the most important processes in living organism that are connected with neural control, memory and thinking. To understand the mechanism of these processes means to recognize the form in which the nervous system receives external and internal information and reacts to it. Vitally important substances were isolated and studied. The information makes it possible to develop preparations for treating diseases of the nervous system, new anesthetics, and artificial memory systems built according to biological principles. E.A.K.

**N86-23224#** Joint Publications Research Service, Arlington, Va.
**INTERACTION OF ASIALOGLYCOPROTEIN RECEPTOR OF HEPATOCYTES WITH CHEMICALLY GALACTOSILATED ACID ALPHA-GLUCOSIDASE Abstract Only**
N. K. Bystrova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 3 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 284, no. 4, Oct. 1985 p 994-996 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The interaction of a mouse hepatic asialoglycoprotein receptor with chemically galactosilated alphaglucosidase (AGC) was studied to determine the feasibility of using such receptors for introducing AGC into hepatic lysosomes. It was shown that binding was specific and predicated on the presence of the galactosyl residue in the AGC molecule. Various galactose-containing substances inhibited the binding to variable extent, with the greatest degree of inhibition exhibited by asialoorosomucoid. The EDTA inhibited binding by more than 79%, confirming the dependence of binding on the presence of calcium ions, a characteristic feature of asialoglycoprotein receptors. It is indicated that under in vitro conditions the receptor recognizes galactosilated AGC as a specific ligand, suggesting that such enzymes can be introduced in this way into hepatic parenchymal cells. This uggests a means of enzyme therapy in such cases as type II glycogenosis. E.A.K.

**N86-23225#** Joint Publications Research Service, Arlington, Va.
**PROTEIN-PROTEIN INTERACTIONS IN SYSTEMS WITH SYNTHETIC POLYELECTROLYTES Abstract Only**
A. L. Margolin, S. F. Sherstyuk, V. A. Izumrudov, V. K. Shvyadas, A. B. Zezin, and V. A. Kabanov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 4 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 284, no. 4, Oct. 1985 p 997-1001 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The efficiency of interaction of alpha-chymotrypsin (ACT) with its basic pancreatic inhibitor on the basis of kinetic data was assessed by using free ACT and ALT covalently linked to polyelectrolytes. The association rate constants in pH 7.5 phosphate buffer at 25 was determined and shows that for the free enzyme in solution, ACT-polymethacrylate complex, and for the CH-agarose linked preparation of ACT, the following values are calculated: 2.8 x 1/10,000, 18.0 x 1/10,000, and 1.4 x 1/10,000 M1/sec-1. The inhibition constants for the three versions of ACT were 3.60 x 10 to the 8th power, 0.40 x 10 to the 8th power and 26.0 x 10 to the 8th power M. It is shown that the methods of enzyme linkage to polyelectrolyte carrier and the nature of the carrier have a profound effect on the binding behavior of the enzyme, and that such facts can be used to alter enzyme behavior toward desired final effects. E.A.K.

**N86-23226#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF INTENSIVE VISIBLE LIGHT ON ACTIVITY OF GLUTATHIONE PEROXIDASE IN PIGMENTED EPITHELIUM OF EYE**
N. R. Veliyeva, E. Yu. Yusifov, and Sh. V. Mamedov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86=002) 8 Jan. 1986 p 5-9 refs Transl. into ENGLISH from Doklady Akademii Nauk Azerbaydzhanskoy SSR (Baku, USSR), v. 41, no. 5, May 1985 p 24-27 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Functional visual damage caused by visible light was studied. The effect of bright light on glutathsione peroxidase (GP) and pigmented epithelium (PE) activity in the retina was investigated. It is shown that GP activity increases in the PE of a frog's eye in response to intense light, and it is suggested that this is associated with the adaptive response to intensified free radical oxidation reactions in the eye's tissues. The important role of GP in the PE is confirmed. E.A.K.

**N86-23227#** Joint Publications Research Service, Arlington, Va.
**DISCOVERY REGARDING ELECTRON REDISTRIBUTION AMONG CELL MEMBRANES Abstract Only** **c52**
I. Novodvorskiy *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 12 Transl. into ENGLISH from Izvestiya (Moscow, USSR), 27 Sep. 1985 p 3 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The transfer of electrons between individual membranes inside a cell and between cells in an organ or tissue. The process of redistribution of electrons between membranes combines all membranes into a single coordinated system. These chemical reactions are delayed and inhibited in a number of illnesses which involve changes in cells and constitute practical application of this discovery since it will help in the diagnosis of serious illnesses. E.A.K.

**N86-23228#** Joint Publications Research Service, Arlington, Va.
**PRODUCTION OF GENE BANK FROM COTTON PLANT CHLOROPLAST DNA FOI HC/MF**
M. Karimov, G. V. Afanasyeva, and N. I. Matviyenko *In its* USSR

Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 16-21 refs Transl. into ENGLISH from Doklady Akademii Nauk Tadzhiksoy SSR (Dushanbe, USSR), v. 28, no. 3, Mar. 1985 p 175-178 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The development of model systems that could make it possible to express eukaryotic genes is discussed. The symbiosis of Agrobacterium tumefaciens in higher plants is used to insert foreign genes into the plants. The plasma genes that are located in the cytoplasm organelles of higher plants, particularly in the chloroplasts are examined. Chloroplast DNA has enough information for the synthesis of a number of protein structures, and its amplification level relies on the expression of its own DNA and foreign DNA altered by genetic engineering techniques. Ribosomal RNA genes of plastids and a large subunit of riboso-diphospate carboxylase are encoded by a chloroplast gene. The insertion of strong promoters into these genes and their supplemental modification, affects the level of photosynthetic activity in plant tissue. One of the stages in changing a genetic program of agricultural plants is the creation of a gene bank of chloroplast DNA. It is demonstrated that the enzyme method of isolating protoplasts from cotton plant leaves followed by mechanical lysis and the lysis of chloropplasts in the presence of proteinase k and supplemental purification on biogel A-50, results in the separation of high polymerchloroplast DNA. E.A.K.

**N86-23229#** Joint Publications Research Service, Arlington, Va.
**PRODUCTION OF GAMMA- AND ALPHA-INTERFERON BY HUMAN BLOOD LEUKOCYTES UNDER SUCCESSIVE INDUCTION CONDITIONS** c52
T. G. Orlova, L. V. Zhdanova, M. N. Soloyeva, and L. M. Mentkevich *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 22-24 refs Transl. into ENGLISH from Voprosy Virusologii (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 196-198 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Alpha and Gamma Interferons are produced by different blood cells--by B lymphocytes and T lymphocytes. This predetermines the possibility for simultaneous or successive induction of the same blood leukocytes by inducers eliciting formation of these types of interferon. When inducers interacting with different producer cells are used in this way, the interferon tolerance phenomenon is avoided. Successive induction means a savings of leukocytes, because the same cells can be used to obtain two yields of interferons. Favorable results in research on production of human gamma - and alpha-interferons involving successive use of gamma interferon inducers--phytohemagglutinin (PGA) and staphylococcal enterotoxin (SEA), and an alpha-interferon inducer--Newcastle disease virus (NDV)--are presented. It is concluded that the double successive induction method of the same human peripheral blood leukocytes allows yields of interferon from gamma and alpha interferons. E.A.K.

**N86-23230#** Joint Publications Research Service, Arlington, Va.
**FARM ANIMALS AS SOURCE OF YERSINIOSIS Abstract Only** c52
Ye. N. Kolos, I. N. Glutov, G. V. Yushchenko, and V. I. Dunayev *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 25-26 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 77-80 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The role of farm animals as sources of yersiniosis in humans and as possible carriers was studied. The linear agglutination method was used to study the disease in cattle, sheep and goats, and swine. Samples from mucous membranes, blood and meat and excrement were analyzed. The clinical course of the disease was like that of dysentery. Study of 252 workers at a meat packing plant showed that as many as 42.5% had antibodies of strain 09, while 39.7% had antibodies of strain 03 and 24.6% had antibodies of strain 05B. Similarly, 42.9% of the workers at a pork processing plant had 03 antibodies, while lesser incidence of other strains was noted. At a milk plant, 30.9% showed antibodies of 05 and 26%, those of strain 08. It is suggested that the likely method of human infection from sheep and swine was by contact, while for cattle it was also alimentary. The Y enterocolitica is considered to be an occupational disease. E.A.K.

**N86-23231#** Joint Publications Research Service, Arlington, Va.
**TEST OF ERYTHROCYTE ANTIGEN DIAGNOSTIC AGENT FOR DETECTING ANTIBODIES TO COXIELLA BURNETTI Abstract Only** c52
N. K. Tokarevich, S. Shramek, and G. A. Bayar *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 26 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 51-55 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The development of a diagnostic procedure and its testing on laboratory models, naturally infected humans and domestic animals is reported. Procedures include determination of the optimum sensitizing dose of lipopolysaccharides (LPS) and preparation of various test and control compounds, and analysis of the retarding effect of passive hemagglutination with a homologous antibody. Negative findings are reported for the serum of laboratory animals not infected with C. burnetti, and there are no false positive results with unsensitized LPS erthrocytes of sheep and data of passive hemagglutination reaction tests with the homologous pathogen. It is indicated that time of detection, titers and the duration of antibody circulation determined by various tests differ markedly. Combined use of complement fixation and passive hemagglutination tests increases the effectiveness of serological detection of Q-fever ricketsiosis, and helps n predicting the course of such infections. E.A.K.

**N86-23232#** Joint Publications Research Service, Arlington, Va.
**DETECTION OF HBsAg IN FAMILIES OF CHILDREN WITH VIRAL HEPATITIS B Abstract Only** c52
A. R. Reyzis, A. N. Drondina, A. A. Asratyan, M. Yu. Ivanova, and L. K. Kozhevnikova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 27 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 48-51 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The incidence of viral hepatitis (VHB) iin a families of children with confirmed cases of the disease is reported. Over a period of 3 years 142 mothers, 81 fathers and 7 relatives of 162 sick children were studied. Control groups included 39 members of 30 children with HBs-negative VH. Serum studies and countercurrent electrophoresis, precipitation and modifications, and passive hemagglutination reaction tests were conducted. The presence of HBsAg was confirmed in 6.9% of the relatives of children with clinically and laboratory confirmed VHB. A lesser number of medical parental involvement was found in HBsAg-positive parents, which suggested domestic infection of the children by chronic carriers of VHB to be a common phenomenon. Use of passive hemagglutination and countercurrent electrophoresis increased the frequency of detection by a factor of 2.4. E.A.K.

**N86-23233#** Joint Publications Research Service, Arlington, Va.
**HBeAg AND ITS ANTIBODIES IN CARRIERS OF HSsAg IN VARIOUS REGIONS OF USSR Abstract Only** c52
M. I. Mikhaylov, S. A. Arakelov, T. Ye. Vorozhbiyeva, S. V. Zhavoronok, S. V. Zubov, A. Ye. Kozhukhar, G. N. Khorvat, and V. A. Ananyev *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 27-28 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 71-74 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The surface antigen of hepatitus B (HBsAg), was studied in

healthy carriers in regions showing various levels of incidence of the disease. Serum of 13,150 donors from the cities of Gorkiy, Vitebsk, Kishinev and Tashkent was studied by precipitation in gel and passive hemagglutination using a diagnostic approach. The HBeAg e-antigen and anti-HBe were determined and data indicate that regions with high incidence of HBsAg also have higher appearance of concentrations of the antigen which could be identified with gel precipitation procedures. The frequency of HBsAg appearance among carriers of the disease antigen is in direct relationship to the level of antigen incidence in a given region, while an inverse relationship is noted for HBeAg. While the level of HBsAg in Gorkiy, Kishinev and Tashkent is 1.4%, 5.0% and 9.0%, respectively, the corresponding figures for HBeAg are 5.5%, 12.3% and 13.3%. E.A.K.

**N86-23234#** Joint Publications Research Service, Arlington, Va.
**SOME CHARACTERISTICS OF EPIZOOTIC PROCESS IN HEMORRHAGIC FEVER WITH RENAL SYNDROME Abstract Only** **c52**
V. N. Bashkirtsev, Ye. V. Ryltseva, Ye. A. Tkachenko, and A. G. Stepanenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-022) 8 Jan. 1986 p 30 Transl. into ENGLISH from Voprosy Virusologii (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 463-468 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Wild rodents caught on natural foci of hemorrhagic fever with renal syndrome (HFRS) in Ufa were analyzed for the presence of specific antigen of HFRS virus, for antibodies to this pathogenic agent and for native HFRS virus. A specific relationship was shown between the infection rate of bank voles with HFRS virus and the levels of circulating antigen and antibody to this virus. The immunity of test animals differed with age, older animals had higher immunity while, the younger animals showed more frequent presence of live virus. When selecting various age groups for isolation of viruses, the younger ones should be taken which have not manifested antibodies to the HFRS virus. E.A.K.

**N86-23235#** Joint Publications Research Service, Arlington, Va.
**AIDS-FREE USSR MONITORING POTENTIAL OUTBREAK THERE Abstract Only** **c52**
*In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 32 ref Transl. into ENGLISH from TRUD (Moscow, USSR), 6 Oct. 1985 p 4 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Clinical factors about the nature of the acquired immune deficiency syndrome (AIDS) and information on its incidence in the USA and on efforts of medical researchers to find a way of fighting it are reported. World health organization data about AIDS and its incidence around the world, and what is known about the virus are summarized. It is stated, that no cases AIDS have been recorded in the USSR. It is assumed that the problem is largely a social one, which is associated with sexual licentiousness, which is tolerated in certain circles in the West, but contrary to the nature of Soviet society. Soviet scientists are studying all aspects of the new diease. Taking part in the general struggle of the medical profession against this exceptionally serious ailment, the Soviet scientists are ready to cooperate with specialists from other countries. E.A.K.

**N86-23236#** Joint Publications Research Service, Arlington, Va.
**ANTIBIOTIC PROPERTIES OF BIFIDOBACTERIA Abstract Only** **c52**
M. B. Sundukova, V. F. Semenikhina, V. I. Ganina, V. V. Pospelova, N. G. Rakhimova, and M. P. Khaleneva *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 33 Transl. into ENGLISH from Molochnaya Promyshlennost (Moscow, USSR), no. 8, Aug. 1985 p 36-38 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The spectrum of antibiotic activity of Bifidobacterium adolescentis MS-42, isolated from the GI-tract of a nursing infant was tested to determine the potential use of this bifidobacterium in the production of dairy products. Growth inhibition studies on Petri dishes showed that B. adolescentis MS-2 yielded inhibitation zones of 26 to 28 mm on streak plates with Shigella flexneri, Sh. sonnei. Straphylococcus aureus 209-p, Proteus vulgaris, and Proteus mirabilis. The antibiotic effects were confirmed with tube-dilution studies, which also encompassed Escherichia coli. In general, B. adolescentis was shown to exhibit greater antibiotic activity than B. bifidum, which is commonly used for enrichment of various darily products. Dietetic and therapeutic darily products were devsed which contain B. adolescentis MS-2. E.A.K.

**N86-23237#** Joint Publications Research Service, Arlington, Va.
**EFFECT OF PLASMIDS ON VIRULENCE OF PSEUDOMONAS AERUGINOSA STRAINS IN MOUSE EXPERIMENTS Abstract Only**
A. S. Yanenko, V. N. Krylov, Ye. S. Stanislavskiy, and Ye. V. Kholodkova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 34 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 19-22 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The effect of plasmids on the virulence of P. aeruginosa PAO strain is reported. Antigen characteristics of P. aeruginosa strains were studied in agglutination reaction on glass with the aid of poly or monovalent agglutinating O-serums of 20 different types. The virulence of 21 strains was studied on white mice. It is shown that the plasmids in PAO strains reduced the virulence of the pathogen. The plasmids that reduce virulence were from various groups of incompatibility and coded various medical resistant determinants with various effects on the growth of P. aeruginosa. Mutations of rpm that stabilized RP4 support in PAO cells also reduced virulence significantly. Chromosome rpm mutations caused changes in cell surfaces of P. aeruginosa. E.A.K.

**N86-23238#** Joint Publications Research Service, Arlington, Va.
**ARTIFICIAL VACCINES AND STIMULATION OF IMMUNITY** **c52**
Valentina Samoilova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 36-37 Repr. from Moscow News (Moscow, USSR), no. 33, 25 Aug. 1 Sep. 1985 p 10 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The creation of artificial vaccines and the possibility to produce an effective vaccine against any disease is discussed. Substances which could stimulate the organism's protective system, bypassing the gene patrol were examined. Such substances were found in some unsuitable polymeric molecules--polyelectrolytes. It is demonstrated that antigen-carrying polymer molecules include only those lymphocytes which can produce antibodies against the alien substance planted on the carrier. The new vaccines for preventing typhus in mice were tested. New vaccine injection into animals made it possible to save all of them from the disease. The dose of th eantigen was from 50 to 100 times less than in the usual vaccine. The virus has three main antigens two of them are proteins positioned on the surface of the virus particle, while the third is hidden int he membrane of the virus. The antigen planted on the polymeric molecule, ensures a strong generation of antibodies and protects the animals after they are infected with the virus. E.A.K.

**N86-23239#** Joint Publications Research Service, Arlington, Va.
**ARTIFICIAL ANTIGENS, VACCINES REVIEWED** **c52**
V. V. Pokrovskiy *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 38-41 refs Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 106-111 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The chemical synthesis of molecular structures with the desired immunobiological characteristics of antigens to agents of infectious

diseases in humans and animals is a new direction in constructing vaccine preparations and bacterial viral diagnostics. The artificial antigens which have a direct relationship to the agents of infectious diseases are examined. The artificial antigens the determinants are arranged in the form of offshoots from a polyacrylamide chain and these antigens possess the serological and immunoenic activity of he prototypes. The serological activity of the artificial antigen in a number of reactions is higher than the natural analog. The serological activity of artificial antigens was strictly group-specific. The unique properties of completely artificial antigens were used in creating highly specific diagnostic systems for immunoenzyme analysis. The artificial antigens activate specific immunity without using adjuvant and protective activity which keeps animals from becoming infected with virulent strains of salmonella. E.A.K.

**N86-23240#** Joint Publications Research Service, Arlington, Va.
**OBTAINING HYBRIDOMAS THAT SYNTHESIZE MONOCLONAL ANTIBODIES TO POLYSACCHARIDE OF GROUP A STREPTOCOCCUS Abstract Only** **c52**
Ye. Yu. Pytyeva and E. I. Drobyshevskaya *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 42 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 35-39 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Production of monoclone antibodies (MCA) for A-polysaccharides for A-polysaccharides (A-PS) using group A streptococcus as the immune agent, and treating the resulting culture with pepsin is reported. Details of cell line identification, screening and storage of clones and production of ascites are summarized. Mice subsequently immunized with the compounds had the lowest titers for A-PS and for the vaccine with lower doses, and the highest with doses of 50 mcg/mouse. Analysis of experiments on determining optimum conditions for forming hybrids of spleen and myeloma cells mice. Screening was done with pepsin created vaccines of group A streptococcus and A-PS. It is shown that three of the monoclonal antibodies have ecipitation properties. Hybrid formation depends on the presence of immune splenocytes, rather than on ratios of myeloma cells and lymphocytes. The high yield of hybrids came with growth of cells in 80 to 100% of alveolic. E.A.K.

**N86-23241#** Joint Publications Research Service, Arlington, Va.
**FAB-FRAGMENT OF HETEROLOGIC IMMUNOGLOBULIN FOR FLU PROPHYLAXIS AND TREATMENT Abstract Only** **c52**
V. I. Degtyarenko, V. F. Zevakov, I. M. Maksimenko, and V. A. Divocha *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-022) 8 Jan. 1986 p 43 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1984 p 114-115 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Enzyme breakdown of heterologic immunoglobulin, particularly the bivalent Fab-fragment of antibodies, were studied for prophylactic and treatment effects. A Rivanol-alcohol method was used to separate the antiinfluenza immunoglobulin. After immunication, hyperimmune antiinfluenza serum was obtained from calves and subjected to enzyme hydrolysis. The effectiveness in neutralizing viruses was assessed. It is indicated that fundamentally new preparations should be studied for serum prophylaxis and serotherapy based on the Fab-fragment. E.A.K.

**N86-23242#** Joint Publications Research Service, Arlington, Va.
**DESCRIPTION OF PREPARATION OF CAPSULAR ANTIGEN ISOLATED FROM YERSINIA PESTIS STRAIN EV Abstract Only** **c52**
V. I. Veynblat, M. M. Titenko, M. S. Verenkov, P. I. Menshov, A. V. Kormilitsyn, O. T. Mozharov, A. A. Shcherbakov, A. S. Vasenin, and S. Yu. Zadumina *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 19-23 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The capsule antigen (FI) plays an important role in the virulence of Y. pestis and is a leading component of antiplague vaccine. The antigen obtained under mild conditions from hydrolysates of animal protein cultivated at 37C for 38 to 46 hours described. The bacterial mass was separated, distilled and dialysed to obtain test materials for passive hemagglutination. Amino acids, sugars, proteins, nucleic acids, polysaccharides and nitrogen were measured, along with the immunochemical activity of FI in comparison to other antiserums. It is indicated that the physicochemical and immunochemical homogeneity and activity of the preparation, along with viscosity, molecular weight, sedimentation and the isoelectric point, are distinct from those of previously known FIA and FIB capsule antigens. The capsule antigen is pure protein and not a glucoproteide. EAK

**N86-23243#** Joint Publications Research Service, Arlington, Va.
**STUDY OF CELL-WALL ANTIGEN DETERMINANTS IN RIBOSOMAL PREPARATIONS OF GROUP A STREPTOCOCCUS Abstract Only** **c52**
A. R. Shikhman, L. V. Nikolayev, O. A. Kondrakova, B. B. Dzantiyev, Ye. I. Blinnikova, N. F. Dmitriyeva, Ye. P. Savelyev, and G. I. Petrov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 15-19 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Ribosomal vaccines offer maximum immunity and minimum secondary reactions. Group A29, M-type, streptococcus ribosomes collected in of antibodies to M-protein, lipoteichoic acid and A-polysaccharides was studied. Double immunodiffusion by the Ouchterlony method were included that immunization of animals with ribosomes of group A29, M-type streptococcus caused development of antibodies to A-polysaccharides and lipoteichoic acid. E.A.K.

**N86-23244#** Joint Publications Research Service, Arlington, Va.
**HYPOXIA PROPHYLAXIS AGAINST RADIATION INJURY** **c52**
Yuri Samoilov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 48-50 Repr. from Moscow News (Moscow, USSR), no. 32, 18-25 Aug. 1985 p 10 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

A method which enables patients to breathe mountainous air was developed. The method also reduces side effects resulting from radiotherapy treatment of malignant tumors. Method for the protection from ionizing radiation was developed. Air similar to that found at the mountain altitudes of 5.3 to 5.5 thousand meters above the sea level is pumped in through a face mask. Its oxygen content is twice as low as that of normal air on the plain. The effectiveness of oxygen-poor air is outlined. The reduction of oxygen content is considered to be a universal way to increase the adaptability potential of the organism, and its survivability under extreme conditions. E.A.K.

**N86-23245#** Joint Publications Research Service, Arlington, Va.
**MANY MEDICAL USES FORESEEN FOR ARTIFICIAL SKIN** **c52**
A. Pominov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences Transl. into ENGLISH from Trud (Moscow, USSR), 25 Sep. 1985 p 4 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

An artificial biological skin was developed. In 5 to 7 days the skin took, and no scars remained. Skin covering the burn was clear and normal, exhibiting only a color difference at first. The artificial skin is a mixture of two liquids a turbid yellow solution and a crystalline coligen, the main protein in connective tissue. The living water is used for burns, serious injuries, cuts, and scratches. E.A.K.

**N86-23246#** Joint Publications Research Service, Arlington, Va.
**MAGNETOPHORE THERAPY** **c33**

Igor Mosin *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 54-55 Repr. from Moscow News (Moscow, USSR), no. 36, 15-22 Sep. 1985 p 10 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The development of magnetophore treatment for medical establishments is described. The magnetophores are applied in clinics, hospitals and research centers. Magnetophores are used to treat radiculitis, hypertension, and insomnia magnetophores are made of various organic of mineral substances mixed with powdery magnetic fillers and later magnetized. E.A.K.

**N86-23247#** Joint Publications Research Service, Arlington, Va.
**SEARCH FOR DNA HOST SPECIFICITY SYSTEMS IN SALMONELLA TYPHI Abstract Only**
A. L. Pashenkov, I. I. Nikolskaya, T. G. Nigmatullin, and S. S. Debov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 57 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1984 p 3-6 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Most specificity systems and their components-restriction and modification enzymes were studied. DNA host specificity systems (HSS) in Salmonella typhi, using O- and Vi-bacteriophages were examined. Reduced effectiveness in phage cultivation was regarded as evidence of a restriction system in a given race. During cloning morphological features such as colony size and form, transparency and the size of negative colony centers and incomplete lysis were recorded. The 11 lines of Vi-phages and 6 lines of O-phages obtained are further classified according to size, transparency and titration potential. Test cross-titration showed DNA HSS in natural hosts and the test phages. It is shown that 10 strains among the titrated lines of S. typhi have DNA host specificity systems. E.A.K.

**N86-23248#** Joint Publications Research Service, Arlington, Va.
**ELECTRIC SLEEP METHOD OF PREVENTING FATIGUE BUILD-UP IN SAILORS ON EXTENDED CRUISES c53**
Yu. Stenko, I. I. Varenikov, and V. A. Skrupskiy *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 60-65 refs Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 5, May 1985 p 42-44 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The effectiveness of drugs and the electric sleep method in the correction of sleep disturbances were compared. It is suggested that the maintenance of normal sleep and the correction of sleep disturbances is kept by prevention of fatigue build up in special forms of work organization in extended sea cruises. It is concluded that electric sleep therapy is the most effective method in the prevention of adverse effects which are the results of the impact of a ship's environmental factors over a period of many months, also includes the cumulative effects of noise. E.A.K.

**N86-23249#** Joint Publications Research Service, Arlington, Va.
**CLONING AND EXPRESSION OF LEPTOSPIRA POMONA HEMOLYSIN GENE IN ESCHERICHIA COLI Abstract Only**
A. A. Dayn, M. N. Rozinov, T. A. Goltsmayer, V. N. Gershanovich, and Yu. G. Chernukha *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 66 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 7-10 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The cloning of the genes in E. Coli a approach to the study of microorganism pathogens is another The L. pomona, which in severe cases is accompanied by yellow jaundice, and its expression in E. coil was studied. Chromosome DNA of L. pomona was obtained by a Fisher-Lerman process, DNA phage by phenol extraction and plasmid DNA by alkaline extraction. Cloning involved a gene inventory of bank nd subsequent screening, using cosmides or vectors based on the lambda phage. Features of fragmentation and cloning are summarized. The recombinant phage carrying the hemolysine gene was selected from phage vector lambda l47.1, and also in the phoUC19 vector. Secretions of hemolysin in the culture of E. coli are not observed. E.A.K.

**N86-23250#** Joint Publications Research Service, Arlington, Va.
**ASSESSMENT OF SELECTED PHYSIOLOGICAL INDICATORS IN ANTENNA OPERATORS AT SHORT-WAVE TRANSMITTING AND RECEIVING CENTERS c52**
L. V. Pokhodzey *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 67-68 Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 7, Jul. 1985 p 36-39 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The effects of electromagnetic emission on personnel servicing antenna feeder systems at short-wave transmitting and receiving stations were assessed. The workers in question were employed at low intermediate, and high wattage stations. No general or long-lasting effects were found on psychological and most physiological parameters, with the different levels of exposure generating a pattern of similar changes which differed somewhat in intensity. Deviations from normal noted, however subsided by the intensity. Deviations from normal noted, however subsided by the end of a working day. The visual analyzer noted functional lability at the end of a day, particularly in workers exposed to the higher intensity fields. Moderate hypotension persisted in workers exposed to moderate and high intensity fields. In all groups hand strength diminished by 18.6 to 25.4% at the end of a working week while the level of reduction in a control--unexposed--group was 10%. Determination of safe levels of electromagnetic exposure requires djustment of radiation intensity. E.A.K.

**N86-23251#** Joint Publications Research Service, Arlington, Va.
**STATUS OF CALCIUM METABOLISM IN COAL MINERS WITH VIBRATION SICKNESS Abstract Only c52**
V. V. Kolomiyets *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 75-76 Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 9, Sep. 1985 p 13-16 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The status of calcium metabolism in coal miners with various degree of vibration sickness was with data from 32 healthy control males. Total and ionized serum calcium levels were significantly elevated in 94 coal miners with vibration sickness, the degree of elevation show a direct correlation with the clinical severity of the illness. The data show that renal calcium clearance and the calcium binding capacity of the serum in the patient group is diminished in comparison with the control subjects. Urine calcium levels did not show any statistical differences between these two gropus. It is indicated that vibration sickness is accompanied by a profound alteration in calcium homestasis, due in large to enhanced calcium resorption in the kidneys. E.A.K.

**N86-23252#** Joint Publications Research Service, Arlington, Va.
**DISEASES IN CEMA COUNTRIES**
Vladimir Petrunya *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86=002) 8 Jan. 1986 p 78-80 Repr. from New Times (Moscow, USSR), no. 36, Sep. 1985 p 22-23 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

The pooling of the efforts of medical specialists from several countries is outlined. The standing committee on cooperation in health services is an international organization which coordinates the need for organ transplants in East European countries. The commission has worked on 13 large-scale composite problems. Among these problems are cardiovascular diseases, malignant tumors, scientific elaboration and unification of methods and means of clinical laboratory diagnosis. Every participating country acts as coordinator of the work on one or another composite problem. Bulgaria coordintes effort in the field of labor hygiene and occupational diseases, Hungary in research in the standardization

of medicines, the G.D.R.--in infectious diseases, and Poland--in maternity and child protection. Czechoslovakia is coordinator of work in transplantation of organs and tissues. E.A.K.

**N86-23253#** Joint Publications Research Service, Arlington, Va.
**MODEL OF EXPERIMENTAL PIXUNA VIRUS INFECTION IN WHITE MICE**
N. P. Chizhov and R. I. Lukyanova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 91-93 refs Transl. into ENGLISH from Voprosy Virusologii (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 214-215 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Use of experimental models of virus-infected animals is an important prerequisite of evaluating the spectrum of action of promising antiviral drugs. The development and use of new experimental models of virus infections comparable or similar in pathogenesis to human diseases are significant in the determination of the preventive and therapeutic effectiveness of antiviral drugs. The development of a nonlethal model of experimental infection evoked by Pixuna alpha-virus which is suitable in the evaluation of the effectiveness of antiviral drugs is discussed. The model of nonlethal disease in white mice which is evoked by Pixuna alpha-virus can be used to evaluate the effectiveness of antiviral preparations and interferon inducers. The models critera for evaluating the effectivenss of antiviral preparations are heir influence on viruse reproduction in the spleen and brain. E.A.K.

**N86-23254#** Joint Publications Research Service, Arlington, Va.
**EXPERIMENTAL EVALUATION OF PATHOGENICITY OF DIFFERENT VARIANTS OF LASSA VIRUS**
A. S. Vladyko, L. Ye. Surikova, T. A. Vovk, I. A. Cherednichenko, and A. V. Torop *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences refs Transl. into ENGLISH from Voprosy Virusologii (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 454-457 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Lasso, Machupo and Khunin belong to the highly pathogenic group of the arenavirus family. Research is conducted with the less-pathogenic lymphocytic choriomeningitis (LCM) virus. One of the directions of research on arenavirus infections is concerned with the problems of the attenuation--acquisition of both nonpathogenic viruses and viruses with reduced pathogenicity. The characteristics (markers) by which the degree of attenuation of the infectious agent can be evaluated was examined. It is established, using LCM virus as an example, that a phenotypic characteristic such as plaque morphology can be used as such a marker. It was discovered that the color of plaques in viruses that do not evoke death of newborn mice differs from the color of plaques created by the initial virus. A dependence between plaque phenotype and pathogenicity is not discovered in LCM virus. The Lassa virus was used to demonstrate the presence of a dependence between plaque phenotype and pathogenicity. The possibility of reducing pathogenicity by conducting a number of passages of the virus in cell culture and in animals is accounted for. Plaque size serves as the phenotypic characteristic of attenuation of Lassa virus. E.A.K.

**N86-23255#** Joint Publications Research Service, Arlington, Va.
**STANDARDIZATION OF CONDITIONS FOR MEASURING INTENSITY OF SPECIFIC FLUORESCENCE IN CONTINUOUS CELL CULTURES INFECTED WITH VARIANTS OF JAPANESE ENCEPHALITIS VIRUS Abstract Only**
Yu. N. Cherednichenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 100 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 57-60 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Luminescent microscopy as a method for studying pathogenesis of human and animal viral infections is discussed. The dynamics of the intensity of imposed fluorescence of marked antibodies tied to the antigen of Japanese encephalitis in vitro were studied. Cells of various origins were tested a passive fluorescent antibody method. Procedures for standardization and perfection of methodology and statistical calculations are summarized. A direct linear correlation is found between pathogen activity of Japanese encephalitis and the intensity of imposed fluorescence of marked antibodies. Continuous Viro and L929 cell cultures are more suitable models for registering induced fluorescence than the HeLa line. E.A.K.

**N86-23256#** Joint Publications Research Service, Arlington, Va.
**VACCINE PROTEINS R AND D ON SALYUT-7 Abstract Only** **c52**
T. Chesanova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 107 Transl. into ENGLISH from Leningradskaya Pravda (Leningrad, USSR), 13 Oct. 1985 p 2 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Experiments performed on Salyut orbiting stations were aimed, at obtaining extrapure hemagglutinin and other surfae proteins of the influenza virus, using the electrophoresis method. The space experiments demonstrated that such products can be obtained in conditions of zero gravity. A new-generation electrophoretic unit the EFU-Robot is used on the Salyut-7 station. The EFU-Robot can be programmed to select samples of substances purified in the course of experiments and automatically transfer the samples from the unit's working chamber to ampules, by syringes. E.A.K.

**N86-23257#** Joint Publications Research Service, Arlington, Va.
**METEOROLOGICAL ADAPTATION RESEARCH AT BIOLOGY INSTITUTE Abstract Only**
Vladimir Nikolayevich Chernyavskiy *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 108-109 Transl. into ENGLISH from Trud (Moscow, USSR), 26 Sep. 1985 p 3 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

Natural mechanisms of anticipation of weather changes in animals and human beings, and effects of weather conditions on human behavior and working fitness were studied. A natural phenomenon, meteorological sounds noise of free atmosphere which is caused by turbulent motion of the air was discovered. The sound reflect the atmosphere properties in a certain area, including the appearance of new air masses in the upper atmosphere. Living organisms unconsciously perceive these sounds, analyze them and modify their behavior accordingly. A hypothesis of human meteorological adaptation proposed that the organism perceives and remembers whole meteorological sound-images which occur at certain intervals in certain localities, and corresponding programs for the readjustment of functional systems of the organism. The biological forecasting mechanism may lead to the development of improved weather-forecasting methods and equipment. An acoustic weather-forecasting method was used in the Rostov-na-Donu area. A medical forecasting method using primary data, based on the meteorological-adaptation hypothesis was also developed. Ecological factors are considered in the forecasting and prevention of illness. E.A.K.

**N86-23258#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES**
12 Mar. 1986 147 p Transl. into ENGLISH from various Russian articles
(JPRS-UBB-86-004) Avail: NTIS HC A07/MF A01

Progress in research and development in USSR life, biomedical, and behavioral sciences is reported. The following areas of interest are discussed: agrotechnology, biochemistry, biophysics, biochemistry, biotechnology, ecology, epidemiology, genetics, immunology, laser effects, marine mammals, medicine, microbiology, molecular biology, pharmacology and toxicology, physiology, public health, psychology, and virology. For individual titles, see N86-23259 through N86-23264.

**N86-23259#** Joint Publications Research Service, Arlington, Va.
**ESTIMATE OF EMOTIONAL STRESS DURING WORKING ACTIVITY BASED ON SYSTEMS ANALYSIS OF SKIN-GALVANIC REACTION Abstract Only** **c52**
G. K. Rakov and Yu. A. Fadeyev *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 101 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 3, May - Jun. 1985 p 463-469 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

Emotional factors of labor and the nature of their relationship to emotional reactions of female electronics-industry workers during assembly and subsequent testing of the electronic-optical system of color kinescopes. Twenty healthy female workers 18 to 40 years of age were determined were studied during assembly of electronic equipment. Significant differences were found between three working stages: (1) pressing in of subassemblies; (2) testing of the capacitance of electron guns; and (3) attachment of cathods holders. It was found that the skin-galvanic reaction is an adequate indicator of emotional stress during working activity. Systems analysis of operations or pressing in assemblies in correlation with development of skin-galvanic responses revealed emotiogenic stages of activity. E.A.K.

**N86-23260#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF COMPLEXITY OF CONTROL TASK ON LEVEL OF ACTIVATION OF OPERATORS PHYSIOLOGICAL FUNCTIONS WHEN WORKING WITH WAITING Abstract Only** **c52**
M. A. Gritsevskiy and Zh. I. Zaytseva *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 102 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 3, May - Jun. 1985 p 504-510 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

Experiments were conducted to answer two questions: (1) do model experiments reveal differences in the functional status in comparing operator's work with various degrees of complexity; and (2) are these changes similar in nature to those manifestations of differing intensity discovered under production conditions. Programs with various specific shares of single and multiple movement control tasks were used to model operators work of varying degrees of complexity. During the experiments, reaction time, EEG, skin-galanic reaction and pulse rate were continually recorded. Differences in bioenergetic activity of the cerebral cortex and differences in autonomic activity and regulations were observed. It is indicated that waiting for signals requiring complex processing is accompanied by higher mobilization of preparedness of the operator. Decreased attention level was observed at the beginning of the day and toward the end of long days. E.A.K.

**N86-23261#** Joint Publications Research Service, Arlington, Va.
**REVIEW OF BOOK ON PRINCIPLES OF AVIATION PSYCHOLOGY Abstract Only** **c53**
A. Morozov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 118 Transl. into ENGLISH from Vozdushnyy Transport (Moscow, USSR), 17 Dec. 1985 p 2 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

Aviation psychology substantiates interrelated principles of occupational screening, the structure of in-flight work, and flight capabilities which are connected with the instruction and training of future pilots is discussed. Psychological features of flight duty, problems of flight capabilities, occupational screening, the formation and maintenance of flight skills, the role of the personal factor in ensuring the quality of flights, the instruction and training of flight personnel, are examined. Recommendations for the use of psychological data to heighten flight safety are formulated. E.A.K.

**N86-23262#** Joint Publications Research Service, Arlington, Va.
**APPARATUS ASSEMBLY FOR PSYCHOPHYSICAL STUDIES ON VISUAL PERCEPTION Abstract Only** **c35**
A. I. Nazarov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 121 Transl. into ENGLISH from Voprosy Psilhologii (Moscow, USSR), no. 3, May-Jun. 1985 p 159-162 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

A schematic outline is presented of an apparatus assembly used for computerized study of visual perception in humans. A screen terminal is used for providing various visual stimuli, which is based on a fast phosphor (P-4). The assembly included a variety of electronic equipment and a newly designed apparatus for visual perception. The adaptability of the assembly is indicated by the fact that the basic set-up has been used for 5 years without significant modifications. E.A.K.

**N86-23263#** Joint Publications Research Service, Arlington, Va.
**METHOD OF CHANGES IN REVERSIBLE PATTERN MASKING AS FACTOR IN VISUAL PERCEPTION Abstract Only** **c52**
V. M. Krol and Ye. I. Bondar *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 122 Transl. into ENGLISH from Voprosy Psikhologii (Moscow, USSR), no. 3, May - Jun. 1985 p 162-164 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MFen1] A01

Temporal characteristics of form perception were analyzed in relation to masking patterns. It is demonstrated that different masks exert different effects on various stages of perception. Three stages were identified in form perception using stimuli consisting of alternating bands and lines arranged in horizontal patterns, and masking patterns consisting either of random curvilinear lines alone or supplemented with solid, short, bands. The different masking patterns exerted different effects (prolongation) on the threshold times for amorphous perception, approximate classification of test pattern, and on object identification. It is demonstrated that different masking patterns significantly affect different stages of form perception, and can be utilized in the analysis of the latter. E.A.K.

**N86-23264#** Joint Publications Research Service, Arlington, Va.
**OXYGEN-LIBERATING MIXTURES FOR BREATHING APPARATUS Abstract Only** **c54**
*In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 131 Transl. into ENGLISH from Sovetskaya Belorussiya (Minsk, USSR), 10 Dec. 1985 p 4 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

Mixtures which are capable at any time of releasing their stored oxygen were prepared. When heated, 100 grams of a substance ground into powder releases more than 40 liters of gas. This is enough to sustain human respiration for several hours in extreme conditions. Such a need may arises in medical practice, in mines, under water, and high in the mountains. The development of these alloys is the result of theoretical and experimental work. Their components are mixtures of salts and inorganic peroxides. E.A.K.

# 52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

**N86-23265*** National Aeronautics and Space Administration, Washington, D.C.
**AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO THE 1985 ISSUES**
Jan. 1986 291 p
(NASA-SP-7011(280); NAS 1.21:70011(280)) Avail: NTIS HC A13 CSCL 06E

This publication is a cumulative index to the abstracts contained in the Supplements 268 through 279 of Aerospace Medicine and Biology: A Continuing Bibliography. It includes seven indexes - subject, personal author, corporate source, foreign technology, contract number, report number, and accession number. Author

**N86-23266** California Univ., Berkeley.
**HUMAN HEAD/NECK/UPPER-TORSO MODEL RESPONSE TO**

**DYNAMIC LOADING Ph.D. Thesis**
Yih-Charng Deng 1985 282 p
Avail: Univ. Microfilms Order No. DA8524927

A human head/neck/upper-torso replica was constructed and instrumented to study its reponse to impact and dynamic loading. The model consists of a water-filled cadaver skull; plastic vertebrae, sternum and ribs; silicon rubber disks and ligaments; and fabric muscles. The static behavior of the system under sagittal plane and lateral loading was adjusted so as to correspond to that of cadaver behavior under similar loading. The tests conducted involved impulsive loading to the torso generated by means of a sled and track system and by direct head impact with a suspended steel ball. A three-dimensional lumped-parameter model of the human head/neck/upper-torso was developed in order to predict its motion for any specified initial conditions that could also be used to compare with other investigators' results. The simulation results indicate favorable comparison with the human volunteer test data for both flexion and lateral whiplash. However, the physical structure appeared to be more flexible than the numerical model. Dissert. Abstr.

**N86-23267** National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
**A SURVEY OF SPEECH AUDIOMETRY IN THE NATIONAL HEALTH SERVICE**
H. C. Fuller and I. K. Moss Aug. 1985 52 p refs
(NPL-AC-105; ISSN-0143-7143) Copyright. Avail: Issuing Activity

Nine clinics in the UK National Health Service (NHS) were visited to discuss with the audiologists the technique of speech audiometry and to observe how the tests were conducted. The information gained was used to construct a questionnaire which was then circulated to NHS hearing aid clinics throughout the UK. Topics covered included the frequency of use of speech audiometry, word lists, recordings, equipment and test procedures, criticisms of test material, and limitations on the use of speech audiometry. Author (ESA)

**N86-23268#** British Aerospace Aircraft Group, Bristol (England). Human Factors Dept.
**THE BAe D TARGET ACQUISITION MODEL ORACLE: AN OVERVIEW, 1984**
J. L. Hinton Feb. 1984 30 p refs
(BAe-JS-10009; BR94986) Avail: Issuing Activity

The concepts used in the ORACLE model of human visual performance, and in system models that may be used with it are outlined. The state of the model is described, including the modeling of human visual performance and treatment of visual aids. Model uses are summarized. Author (ESA)

**N86-23269#** Sloan-Kettering Inst. for Cancer Research, New York.
**BIOMEDICAL RESEARCH WITH CYCLOTRON PRODUCED RADIONUCLIDES Progress Report, 1 Aug. 1984 - 31 Jul. 1985**
J. S. Laughlin 31 Aug. 1985 62 p refs
(Contract DE-AC02-77EV-04268)
(DE86-000327; DOE/EV-04268/T4) Avail: NTIS HC A04/MF A01

Nine interrelated studies are reported on experimental and clinical uses of nitrogen-13 or carbon-11. Chemical and enzymatical methods are provided for the production of labelled amino acids. Comparative distribution studies of N-13 ammonia, glutamine, (ALPHA)-aminobutyric acid, methionine, valine, leucine, and glutamate after retro-orbital injection have been completed. The data show most of the label (% dose/organ) going to liver and muscle regardless of the injected agent. DOE

**N86-23270#** Oak Ridge National Lab., Tenn.
**RADIATION INDUCTION OF CANCER OF THE SKIN**
R. J. M. Fry, J. B. Storer, and F. J. Burns 1985 13 p refs Presented at the Workshop on Radiation Damage To Skin: Fundamental and Practical Aspects, Paris, France, 9 Oct. 1985 Prepared in cooperation with New York Univ., N.Y.
(Contract DE-AC05-84OR-21400)
(DE86-002201; CONF-851065-1) Avail: NTIS HC A02/MF A01

The induction of epidermal tumors was studied using exposures to 25 kV X-rays with or without subsequent exposures to 12-0-tetradeconyl phorbol-13 acetate (TPA) or ultraviolet radiation (UVR) 280 to 400 nm. Fractionation regimens and total exposure up to 4000R produced no squamous cell carcinomas. When these regimes were followed by TPA an incidence of about 80% was obtained, and incidence of 60% when UVR exposures followed the x-irradiation. A dose-dependent increase in fibrosarcomas was found when x-irradiation was followed by 24 weeks of topical treatment with TPA. These results support the contention that UVR can enhance the expression of cells initiated by X-rays. The experimental evidence is compared with the data from the tinea capitis patients treated with X-rays. In C3HF/He male mice exposed to 50, 100, 150 and 200 rads (137)Cs gamma rays the induction rate for fibrosarcomas was 2.9 x 10(-4) per cGy/per mouse. This result compares with 2.5 x 10(-6) transformations per surviving cell per cGy with 10T1/2 cells that are fibroblasts derived from C3H mice. DOE

**N86-23271#** Oak Ridge National Lab., Tenn.
**PRODUCTION AND CHARACTERIZATION OF ANTIBODIES TO BENZO(A)PYRENE**
G. D. Griffin, K. R. Ambrose, R. N. Thomason, C. M. Murchison, M. McManis, P. G. R. St.Wecker, and T. Vo-Dinh 1985 13 p refs Presented at the 10th International Symposium on Polynuclear Aromatic Hydrocarbons, Columbus, Ohio, 21 Oct. 1985 Prepared in cooperation with Tennessee Univ., Knoxville, Tenn.
(Contract DE-AC05-84OR-21400)
(DE86-002204; CONF-851068-3) Avail: NTIS HC A02/MF A01

This report describes the preparation of antibodies to benzopyrene labelled bovine serum albumin. DOE

**N86-23272#** Food and Drug Administration, Rockville, Md. Center for Devices and Radiological Health.
**MEASUREMENT TECHNIQUES FOR USE WITH TECHNIQUE/EXPOSURE GUIDES Final Report**
E. F. Manny and R. L. Burkhardt Aug. 1985 30 p
(PB86-123718; HHS/PUB/FDA-85-8248; FDA/CDRH-86/7) Avail: NTIS HC A03/MF A01 CSCL 06E

The Center for devices and Radiological Health recommends that diagnostic radiology facilities evaluate the radiation exposure received by their patients. The technical factors which must be considered in instituting a radiation exposure measurement program as a basis for this evaluation are discussed. Center radiation exposure measurement methods are described. GRA

**N86-23273#** Food and Drug Administration, Rockville, Md. Center for Devices and Radiological Health.
**EVALUATION OF RADIATION EXPOSURE FROM DIAGNOSTIC RADIOLOGY EXAMINATIONS: GENERAL RECOMMENDATIONS Final Report**
Aug. 1985 10 p refs
(PB86-125903; HHS/PUB/FDA-85-8246; FDA/CDRH-86/5) Avail: NTIS HC A02/MF A01 CSCL 06E

Optimization of the medical radiation the public receives by minimizing unnecessary radiation exposure and improving the diagnostic benefit from the necessary exposure is discussed. Steps toward this goal include a performance standard for the manufacture and installation of X-ray equipment, quality assurance guidance for the maintenance of the equipment, training in the proper use of the equipment, and selection criteria for X-ray examinations. Recommendations are listed that introduce an additional basic step. GRA

**N86-23274#** Food and Drug Administration, Rockville, Md. Center for Devices and Radiological Health.
**EVALUATION OF RADIATION EXPOSURE FROM DIAGNOSTIC RADIOLOGY EXAMINATIONS: TECHNIQUE/EXPOSURE GUIDES FOR THE CRANIOCAUDAL PROJECTION IN MAMMOGRAPHY Final Report**
Aug. 1985 10 p refs

(PB86-126075; DHHS/PUB/FDA-85-8244; FDA/CDRH-86/4) Avail: NTIS HC A02/MF A01 CSCL 06E

Suggestions for appropriate Technique/Exposure guides for use with the mammographic craniocaudal projection are presented. This type of projection is the most commonly used mammographic view and much exposure data is available for it. Problems affecting radiation exposure and image quality with one projection often are problems affecting all projections conducted with a particular X-ray imaging systems. The use of T/E guides to detect and correct the problems with the craniocaudal projection will have a beneficial effect on exposure levels and image quality of other projections conducted on the same system. GRA

**N86-23275#** Food and Drug Administration, Rockville, Md. Center for Devices and Radiological Health.

**BEHAVIORAL EFFECTS OF MICROWAVE RADIATION ABSORPTION Final Report**

J. C. Monahan and J. A. DAndrea Aug. 1985 173 p refs Prepared in cooperation with Utah Univ., Salt Lake City

(PB86-113735; HHS/PUB/FDA-85-8238; FDA/CDRH-85/72) Avail: NTIS HC A08/MF A01 CSCL 06R

The need for an understanding of the biological effects induced by exposure to microwave radiation has increased in recent years because of increased usage and applications and also concerns about potential adverse health effects. Although many research studies have been conducted to examine the question of biological effects, the information is scattered in many diverse sources. This publication brings together in a single source the major research findings related to the behavioral consequences of microwave exposure. In addition it attempts to provide a critical assessment of this information and to provide a perspective upon which the reader can interpret the findings. This publication begins with a review of behavioral-microwave research in the Soviet Union and then proceeds to examine the work of researchers in the Western countries. Both learned and unlearned behaviors are examined in the context of microwave induced effects. GRA

**N86-23276#** Health Effects Research Lab., Research Triangle Park, N. C.

**SYSTEM FOR MEASUREMENT OF SMALL VIBRATIONS AT MATERIAL INTERFACES INDUCED BY ELECTROSTRICTIVE FORCES**

J. S. Ali and W. T. Joines Oct. 1985 157 p refs

(PB86-116530; EPA-600/1-85-021) Avail: NTIS HC A08/MF A01 CSCL 06B

The mechanisms of interaction of ELF and ELF-modulated RF fields with biological systems is presently an active area of research. Some models propose that field-induced forces may influence certain observed biological effects such as RF hearing and calcium ion efflux. To investigate the validity of the field-induced force model for the calcium-ion efflux effect, a system is needed which is capable of exposing samples to ELF fields or to ELF-modulated RF fields. At the same time the induced vibration caused by the forces of electrostriction must be monitored preferably by a non-contacting method. A microwave phase-sensitive receiver was designed to sense the small vibrations. Limitations on the receiver sensitivity imposed by phase noise is discussed. Phase noise measurement systems were designed and used to charactrize the key receiver components. A limiting amplifier in the IF section of the receiver eliminates the need for knowledge of the reflection coefficient of the object of interest for quantitative vibration measurements. GRA

**N86-23277#** Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

**HUMAN REACTIONS TO TRANSIENT ELECTRIC CURRENTS Final Report**

J. P. Reilly and W. D. Larkin Jun. 1985 172 p Sponsored in part by the Maryland Dept. of Natural Resources, Annapolis and the Canadian Electrical Association, Montreal, Quebec

(PB86-117280; PPSP/JHU/PPSE-T-34) Avail: NTIS HC A08/MF A01 CSCL 06P

Research carried out at the Johns Hopkins University Applied Physics Laboratory on aspects of human sensitivity to transient electrical stimulation is described. High-voltage short-duration currents of the kinds that may be encountered near power substations, transmission lines, or industrial apparatus are emphasized. Human sensitivity is measured for a variety of stimulating conditions, both at the threshold of perception and above it, up to the tolerance limit. A neural excitation model is invoked to account for a wide array of sensory effects, and to serve as a framework for predicting effects not studied. Among the factors studied are: voltage, capacitance; polarity, waveshape, and duration of the stimulating waveforms; ac versus dc stimulating; electrode approach velocity and contact force; skin temperature; skin resistance; skin hydration; electrode contact area; and stimulated body location. GRA

**N86-23227#** Joint Publications Research Service, Arlington, Va.

**DISCOVERY REGARDING ELECTRON REDISTRIBUTION AMONG CELL MEMBRANES Abstract Only**

I. Novodvorskiy *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 12 Transl. into ENGLISH from Izvestiya (Moscow, USSR), 27 Sep. 1985 p 3 (For primary document see N86-23222 13-51)

Avail: NTIS HC A06

**N86-23229#** Joint Publications Research Service, Arlington, Va.

**PRODUCTION OF GAMMA- AND ALPHA-INTERFERON BY HUMAN BLOOD LEUKOCYTES UNDER SUCCESSIVE INDUCTION CONDITIONS**

T. G. Orlova, L. V. Zhdanova, M. N. Soloyeva, and L. M. Mentkevich *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 22-24 refs Transl. into ENGLISH from Voprosy Virusologii (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 196-198 (For primary document see N86-23222 13-51)

Avail: NTIS HC A06

**N86-23230#** Joint Publications Research Service, Arlington, Va.

**FARM ANIMALS AS SOURCE OF YERSINIOSIS Abstract Only**

Ye. N. Kolos, I. N. Giutov, G. V. Yushchenko, and V. I. Dunayev *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 25-26 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 77-80 (For primary document see N86-23222 13-51)

Avail: NTIS HC A06

**N86-23231#** Joint Publications Research Service, Arlington, Va.

**TEST OF ERYTHROCYTE ANTIGEN DIAGNOSTIC AGENT FOR DETECTING ANTIBODIES TO COXIELLA BURNETTI Abstract Only**

N. K. Tokarevich, S. Shramek, and G. A. Bayar *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 26 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 51-55 (For primary document see N86-23222 13-51)

Avail: NTIS HC A06

**N86-23232#** Joint Publications Research Service, Arlington, Va.

**DETECTION OF HBsAg IN FAMILIES OF CHILDREN WITH VIRAL HEPATITIS B Abstract Only**

A. R. Reyzis, A. N. Drondina, A. A. Asratyan, M. Yu. Ivanova, and L. K. Kozhevnikova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 27 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 48-51 (For primary document see N86-23222 13-51)

Avail: NTIS HC A06

**N86-23233#** Joint Publications Research Service, Arlington, Va.

**HBeAg AND ITS ANTIBODIES IN CARRIERS OF HSsAg IN VARIOUS REGIONS OF USSR Abstract Only**

M. I. Mikhaylov, S. A. Arakelov, T. Ye. Vorozhbiyeva, S. V. Zhavoronok, S. V. Zubov, A. Ye. Kozhukhar, G. N. Khorvat, and

V. A. Ananyev *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 27-28 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 71-74 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23234#** Joint Publications Research Service, Arlington, Va.
**SOME CHARACTERISTICS OF EPIZOOTIC PROCESS IN HEMORRHAGIC FEVER WITH RENAL SYNDROME Abstract Only**
V. N. Bashkirtsev, Ye. V. Ryltseva, Ye. A. Tkachenko, and A. G. Stepanenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-022) 8 Jan. 1986 p 30 Transl. into ENGLISH from Voprosy Virusologii (Moscow, USSR), no. 4, Jul. - Aug. 1985 p 463-468 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23235#** Joint Publications Research Service, Arlington, Va.
**AIDS-FREE USSR MONITORING POTENTIAL OUTBREAK THERE Abstract Only**
*In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 32 ref Transl. into ENGLISH from TRUD (Moscow, USSR), 6 Oct. 1985 p 4 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23236#** Joint Publications Research Service, Arlington, Va.
**ANTIBIOTIC PROPERTIES OF BIFIDOBACTERIA Abstract Only**
M. B. Sundukova, V. F. Semenikhina, V. I. Ganina, V. V. Pospelova, N. G. Rakhimova, and M. P. Khaleneva *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 33 Transl. into ENGLISH from Molochnaya Promyshlennost (Moscow, USSR), no. 8, Aug. 1985 p 36-38 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23238#** Joint Publications Research Service, Arlington, Va.
**ARTIFICIAL VACCINES AND STIMULATION OF IMMUNITY**
Valentina Samoilova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 36-37 Repr. from Moscow News (Moscow, USSR), no. 33, 25 Aug. 1 Sep. 1985 p 10 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23239#** Joint Publications Research Service, Arlington, Va.
**ARTIFICIAL ANTIGENS, VACCINES REVIEWED**
V. V. Pokrovskiy *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 38-41 refs Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 106-111 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23240#** Joint Publications Research Service, Arlington, Va.
**OBTAINING HYBRIDOMAS THAT SYNTHESIZE MONOCLONAL ANTIBODIES TO POLYSACCHARIDE OF GROUP A STREPTOCOCCUS Abstract Only**
Ye. Yu. Pytyeva and E. I. Drobyshevskaya *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 42 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 7, Jul. 1985 p 35-39 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23241#** Joint Publications Research Service, Arlington, Va.
**FAB-FRAGMENT OF HETEROLOGIC IMMUNOGLOBULIN FOR FLU PROPHYLAXIS AND TREATMENT Abstract Only**
V. I. Degtyarenko, V. F. Zevakov, I. M. Maksimenko, and V. A. Divocha *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-022) 8 Jan. 1986 p 43 Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1984 p 114-115 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23242#** Joint Publications Research Service, Arlington, Va.
**DESCRIPTION OF PREPARATION OF CAPSULAR ANTIGEN ISOLATED FROM YERSINIA PESTIS STRAIN EV Abstract Only**
V. I. Veynblat, M. M. Titenko, M. S. Verenkov, P. I. Menshov, A. V. Kormilitsyn, O. T. Mozharov, A. A. Shcherbakov, A. S. Vasenin, and S. Yu. Zadumina *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 19-23 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23243#** Joint Publications Research Service, Arlington, Va.
**STUDY OF CELL-WALL ANTIGEN DETERMINANTS IN RIBOSOMAL PREPARATIONS OF GROUP A STREPTOCOCCUS Abstract Only**
A. R. Shikhman, L. V. Nikolayev, O. A. Kondrakova, B. B. Dzantiyev, Ye. I. Blinnikova, N. F. Dmitriyeva, Ye. P. Savelyev, and G. I. Petrov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences Transl. into ENGLISH from Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow, USSR), no. 4, Apr. 1985 p 15-19 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23244#** Joint Publications Research Service, Arlington, Va.
**HYPOXIA PROPHYLAXIS AGAINST RADIATION INJURY**
Yuri Samoilov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 48-50 Repr. from Moscow News (Moscow, USSR), no. 32, 18-25 Aug. 1985 p 10 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23245#** Joint Publications Research Service, Arlington, Va.
**MANY MEDICAL USES FORESEEN FOR ARTIFICIAL SKIN**
A. Pominov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences Transl. into ENGLISH from Trud (Moscow, USSR), 25 Sep. 1985 p 4 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23250#** Joint Publications Research Service, Arlington, Va.
**ASSESSMENT OF SELECTED PHYSIOLOGICAL INDICATORS IN ANTENNA OPERATORS AT SHORT-WAVE TRANSMITTING AND RECEIVING CENTERS**
L. V. Pokhodzey *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 67-68 Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 7, Jul. 1985 p 36-39 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23251#** Joint Publications Research Service, Arlington, Va.
**STATUS OF CALCIUM METABOLISM IN COAL MINERS WITH VIBRATION SICKNESS Abstract Only**
V. V. Kolomiyets *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 75-76 Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 9, Sep. 1985 p 13-16 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23256#** Joint Publications Research Service, Arlington, Va.
**VACCINE PROTEINS R AND D ON SALYUT-7 Abstract Only**
T. Chesanova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 107 Transl. into ENGLISH from Leningradskaya Pravda (Leningrad, USSR), 13 Oct. 1985 p 2 (For primary document see N86-23222

13-51)
Avail: NTIS HC A06

**N86-23259#** Joint Publications Research Service, Arlington, Va.
**ESTIMATE OF EMOTIONAL STRESS DURING WORKING ACTIVITY BASED ON SYSTEMS ANALYSIS OF SKIN-GALVANIC REACTION Abstract Only**
G. K. Rakov and Yu. A. Fadeyev *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 101 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 3, May - Jun. 1985 p 463-469 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

**N86-23260#** Joint Publications Research Service, Arlington, Va.
**INFLUENCE OF COMPLEXITY OF CONTROL TASK ON LEVEL OF ACTIVATION OF OPERATORS PHYSIOLOGICAL FUNCTIONS WHEN WORKING WITH WAITING Abstract Only**
M. A. Gritsevskiy and Zh. I. Zaytseva *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 102 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 3, May - Jun. 1985 p 504-510 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

**N86-23263#** Joint Publications Research Service, Arlington, Va.
**METHOD OF CHANGES IN REVERSIBLE PATTERN MASKING AS FACTOR IN VISUAL PERCEPTION Abstract Only**
V. M. Krol and Ye. I. Bondar *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 122 Transl. into ENGLISH from Voprosy Psikhologii (Moscow, USSR), no. 3, May - Jun. 1985 p 162-164 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MFen1] A01

# 53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**N86-23278#** Defence Research Information Centre, Orpington (England).
**PSYCHOLOGICAL SELECTION OF PERSONNEL FOR EMPLOYMENT IN THE ANTARCTIC**
L. Crocq, J. Rivolier, and G. Cazes Mar. 1985 21 p Transl. into ENGLISH from Medecine et Armees vol. 1, no. 7, 1973
(DRIC-T-7449; BR95294) HC A02/MF A01

Selection methods and methods of behavior monitoring of subjects wintering in Antarctic bases are described. The psychological selection aims to predict the adaptability of the subject to the extreme environment. Procedures for carrying out objective studies in the field of individual and collective phenomena of maladjustment, and the factors which determine or promote them are discussed. Author (ESA)

**N86-23279#** Harvard Univ., Cambridge, Mass.
**VISUAL HEMISPHERIC SPECIALIZATION: A COMPUTATIONAL THEORY Technical Report, 1 Apr. - 31 Oct. 1985**
Stephen M. Kosslyn 31 Oct. 1985 82 p
(Contract N00014-85-K-0291)
(AD-A161296; TR-7) Avail: NTIS HC A05/MF A01 CSCL 12/1

Visual recognition, navigation, tracking and imagery are deposited to involve some of the same types of representations and processes. The first part of this paper develops a theory of some of the shared types of representations and processing modules. This theory is developed in light of computational, neuroanatomical, neurophysiological, and behavioral considerations. The second part of the paper develops a mechanism for the development of lateralization of visual function in the brain. This theory leads to predictions about the lateralization of the putative processing modules. The third part of the paper examines critical tests of these predictions, and reviews relevant empirical findings in the literature. Author (GRA)

**N86-23280#** Research Inst. of National Defence, Stockholm (Sweden). Dept. 5.
**REPORT FROM A BEHAVIORAL SCIENCE STUDY GRIP TO AUSTRALIA, 23 AUG. - 10 SEP. 1985**
Gerry Larsson Oct. 1985 12 p refs In SWEDISH; ENGLISH summary
(FOA-C-50027-H3; ISSN-0347-7665) Avail: NTIS HC A02/MF A01

Mental stimulation and means to overcome stress are discussed. Practical techniques and measuring instruments for mental stimulation are commented on. A positive correlation between arousal level and performance, and negative correlation for anxiety and performance are considered. As both exist in variable proportions in practice, the total performance may be represented as an inverted U-curve. Decision making under stress conditions is analyzed. Author (ESA)

**N86-23248#** Joint Publications Research Service, Arlington, Va.
**ELECTRIC SLEEP METHOD OF PREVENTING FATIGUE BUILD-UP IN SAILORS ON EXTENDED CRUISES**
Yu. Stenko, I. I. Varenikov, and V. A. Skrupskiy *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-002) 8 Jan. 1986 p 60-65 refs Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 5, May 1985 p 42-44 (For primary document see N86-23222 13-51)
Avail: NTIS HC A06

**N86-23261#** Joint Publications Research Service, Arlington, Va.
**REVIEW OF BOOK ON PRINCIPLES OF AVIATION PSYCHOLOGY Abstract Only**
A. Morozov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 118 Transl. into ENGLISH from Vozdushnyy Transport (Moscow, USSR), 17 Dec. 1985 p 2 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

# 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**N86-23281#** Lawrence Livermore National Lab., Calif.
**DESIGN GUIDELINES FOR THE USE OF AUDIO CUES IN COMPUTER INTERFACES**
D. A. Sumikawa, M. M. Blattner, K. I. Joy, and R. M. Greenberg Jul. 1985 25 p Presented at the 19th Annual Hawaii International Conference on System Sciences, Honolulu, Hawaii, 8 Jan. 1986 Prepared in cooperation with California Univ., Davis, Calif.
(Contract W-7405-eng-48)
(DE85-015176; UCRL-92925; CONF-860107-1) Avail: NTIS HC A02/MF A01

A logical next step in the evolution of the computer-user interface is the incorporation of sound thereby using our senses of hearing in our communication with the computer. This allows our visual and auditory capacities to work in unison leading to a more effective and efficient interpretation of information received from the computer than by sight alone. In this paper we examine earcons, which are audio cues, used in the computer-user interface to provide information and feedback to the user about computer entities (these include messages and functions, as well as states and labels). The material in this paper is part of a larger study that recommends guidelines for the design and use of audio cues in the computer-user interface. The complete work examines the disciplines of music, psychology, communication theory, advertising, and psychoacoustics to discover how sound is utilized and analyzed in those areas. The resulting information is organized according

to the theory of semiotics, the theory of signs, into the syntax, semantics, and pragmatics of communication by sound. Here we present design guidelines for the syntax of earcons. DOE

**N86-23264#** Joint Publications Research Service, Arlington, Va.
**OXYGEN-LIBERATING MIXTURES FOR BREATHING APPARATUS Abstract Only**
*In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) 12 Mar. 1986 p 131 Transl. into ENGLISH from Sovetskaya Belorussiya (Minsk, USSR), 10 Dec. 1985 p 4 (For primary document see N86-23258 13-51)
Avail: NTIS HC A07/MF A01

# 55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

# 59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

**N86-23282*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE ALGEBRAIC GRID-GENERATION TECHNIQUE**
R. E. Smith and M. R. Wiese (Computer Sciences Corp., Hampton, Va.) Mar. 1986 40 p refs
(NASA-TP-2533; L-16019; NAS 1.60:2533) Avail: NTIS HC A03/MF A01 CSCL 12A

An algebraic grid generation technique and use of an associated interactive computer program are described. The technique, called the two boundary technique, is based on Hermite cubic interpolation between two fixed, nonintersecting boundaries. The boundaries are referred to as the bottom and top, and they are defined by two ordered sets of points. Left and right side boundaries which intersect the bottom and top boundaries may also be specified by two ordered sets of points. when side boundaries are specified, linear blending functions are used to conform interior interpolation to the side boundaries. Spacing between physical grid coordinates is determined as a function of boundary data and uniformly space computational coordinates. Control functions relating computational coordinates to parametric intermediate variables that affect the distance between grid points are embedded in the interpolation formulas. A versatile control function technique with smooth-cubic-spline functions is presented. The technique works best in an interactive graphics environment where computational displays and user responses are quickly exchanged. An interactive computer program based on the technique and called TBGG (two boundary grid generation) is also described. Author

# 60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

**N86-23283*#** National Aeronautics and Space Administration. Pasadena Office, Calif.
**PROGRAMMABLE PIPELINED IMAGE PROCESSOR Patent Application**
Donald B. Gennery and Brian Wilcox, inventors (to NASA) Filed 31 Dec. 1985 31 p
(Contract NAS7-918)
(NASA-Case-NPO-16461-1CU; NAS 1.71:NPO-16461-1CU; US-Patent-Appl-SN-815103) Avail: NTIS HC A03/MF A01 CSCL 09B

A pipelined image processor selectively interconnects modules in a column of a two dimensional array to modules of the next column of the array of modules 1,1 through M,N, where M is the number of modules in one dimension and N is the number of modules in the other direction. Each module includes two input selectors for A and B inputs, two convolvers, a binary function operator, a neighborhood comparison operator which produces an A output and an output selector which may select as a B output the output of any one of the components in the module, including the A output of the neighborhood comparison operator. Each module may be connected to as many as eight modules in the next column, preferably with the majority always in a different row that is up (or down) in the array for a generally spiral data path around the torus thus formed. The binary function operator is implemented as a look-up table addressed by the most significant 8 bits of each 12-bit argument. The table output includes a function a function value and the slopes for interpolation of the two arguments by multiplying the 4 least significant bits in multipliers and adding the products to the function value through adders.
NASA

**N86-23284#** Department of the Air Force, Washington, D.C.
**HIDDEN FAULT BIT APPARATUS FOR A SELF-ORGANIZING DIGITAL PROCESSOR SYSTEM Patent Application**
Malcolm Frazier, inventor (to Air Force) Filed 21 Oct. 1985 14 p
(AD-D012006; US-Patent-Appl-SN-789862) Avail: NTIS HC A02/MF A01 CSCL 09/2

A hidden fault bit apparatus for a self-organizing digital processor system utilizing a single bit of non-volatile memory to store a hidden fault bit in each digital processor unit of the system. The hidden fault bit indicates that the digital processor which contains it, is believed to contain a hidden fault and therefore, should not participate in the self-organization process.
Author (GRA)

**N86-23285#** Lawrence Livermore National Lab., Calif.
**SOLID MODELING RESEARCH AT LAWRENCE LIVERMORE NATIONAL LABORATORY: 1982-1985**
J. R. Kalibjian 1 Sep. 1985 14 p
(Contract W-7405-eng-48)
(DE86-002608; UCRL-53652) Avail: NTIS HC A02/MF A01

The Lawrence Livermore National Laboratory has sponsored solid modeling research for the past four years to assess this new technology and to determine its potential benefits to the Nuclear Weapons Complex. We summarize here the results of five projects implemented during our effort. First, we have installed two solid modeler codes, TIPS-1 (Technical Information Processing System-1) and PADL-2 (Part and Assembly Description Language), on the Laboratory's CRAY-1 computers. Further, we have extended the geometric coverage and have enhanced the graphics capabilities of the TIPS-1 modeler. To enhance solid modeler performance on our OCTOPUS computer system, we have also developed a method to permit future use of the Laboratory's network video system to provide high-resolution, shaded images at users' locations. Finally, we have begun to implement code that will link solid-modeler data bases to finite-element meshing codes. DOE

**N86-23286#** Los Alamos National Lab., N. Mex.
**ALTERNATIVES TO MAINFRAMES FOR TEXT AND GRAPHIC PUBLISHING**
G. W. Webb 1985 6 p Presented at the 7th Lasers in Graphics Annual Conference, Nashville, Tenn., 29 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000792; LA-UR-85-3512; CONF-8509188-1) Avail: NTIS HC A02/MF A01

For the past 10 years large publication facilities have been using mainframe computers and laser output devices to set pages of type with graphics and even photographs imbedded in the text.

Mainframe computers have some real advantages, such as software packages that produce beautiful graphs, very efficient word processing, and incomparable typesetting. But these computers are expensive to own and operate and would be excessive for the small publications shop. For a company that does not have $100,000 to spend on a computer, typesetter, and electronic publishing system there is an alternative: a microcomputer-based word processing system. A microcomputer coupled with a laser printer or even a phototypesetting unit can cost less than $25,000 and produce high-quality results. DOE

**N86-23287#** Allied Bendix Corp., Kansas City, Mo. Bendix Kansas City Div.
**NUMERICAL CONTROL USER EXPERIENCE**
J. Butler Oct. 1985 12 p Presented at the VIM-43 Conference, Minneapolis, Minn., 7 Oct. 1985
(Contract DE-AC04-76DP-00613)
(DE86-001298; BDX-613-3385; CONF-8510179-1) Avail: NTIS HC A02/MF A01

AUTOCON is an acronym for Automatic Contouring, a program which generates a contour toolpath for the external profile of printed writing boards (PWB) using ICEM DDN. AUTOCON originates from the Computer Aided Process Planning (CAPP) Procedure developed by Electrical Manufacturing at Allied Bendix. The CAPP program uses electronically transmitted graphics files received from a design agency to generate automatic panel layouts and travellers for Process Engineers. The objective of AUTOCON is to utilize the information from the CAPP program to generate Numerical Control tapes. If the CAPP program can be utilized to its full potential, it is estimated that a good portion of the 60 to 90 PWB tapes shipped each month from our Numerical Control Department could be eliminated from conventional N/C Programming. The purpose of AUTOCON is to automatically generate a toolpath around the external profile of a PWB with no user intervention. The Process Engineer can generate a profile contour N/C tape after he has completed the panel layout and traveller through CAPPS for a part. After the layout and traveller illustrations have been completed, the same geometry can then be utilized again for the N/C tape. An N/C Analysist then reviews the listing for a final checkout of the job. DOE

**N86-23288#** Oak Ridge National Lab., Tenn.
**COLUMN LU FACTORIZATION WITH PIVOTING ON A HYPERCUBE MULTIPROCESSOR**
G. J. Davis Nov. 1985 25 p
(Contract DE-AC05-84OR-21400)
(DE86-002555; ORNL-6219) Avail: NTIS HC A02/MF A01

A column-oriented algorithm is presented for LU factorization with partial pivoting. Two different mappings of columns to processors are considered. Forward and backsubstitution algorithms to use the factorization for solving linear systems are developed. Timing data, including processor utilization and load balancing, are provided by a hypercube simulator. DOE

**N86-23289#** Pacific Northwest Lab., Richland, Wash.
**FACILITY/EQUIPMENT PERFORMANCE EVALUATION USING MICROCOMPUTER SIMULATION ANALYSIS**
A. D. Chockie and C. J. Hostick Aug. 1985 6 p Presented at the American Nuclear Society Winter Meeting, San Francisco, Calif., 10 Nov. 1985
(Contract DE-AC06-76RL-01830)
(DE86-002814; PNL-SA-13279; CONF-851115-37) Avail: NTIS HC A02/MF A01

A computer simulation analysis model was developed at the Pacific Northwest Laboratory to assist in assuring the adequacy of the Monitored Retrievable Storage facility design to meet the specified spent nuclear fuel throughput requirements. The microcomputer-based model was applied to the analysis of material flow, equipment capability and facility layout. The simulation analysis evaluated uncertainties concerning both facility throughput requirements and process duration times as part of the development of a comprehensive estimate of facility performance. The evaluations provided feedback into the design review task to identify areas where design modifications should be considered. DOE

**N86-23290#** Oak Ridge National Lab., Tenn.
**ORNL 25 MV TANDEM ACCELERATOR CONTROL SYSTEM**
R. C. Juras, J. A. Biggerstaff, and D. E. Hoglund 1985 14 p Presented at the 2nd International Workshop on Accelerator Control Systems, Los Alamos, N. Mex., 7 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002211; CONF-8510194-1) Avail: NTIS HC A02/MF A01

The CAMAC-based control system for the 25 MV tandem electrostatic accelerator of the Holifield Heavy Ion Research Facility at Oak Ridge National Laboratory (ORNL) was specified by ORNL and built by the National Electrostatics Corporation. Two Perkin-Elmer 32-bit minicomputers are used in the system, a message switching computer and a supervisory computer. The message switching computer transmits and receives control information on six serial highways. This computer shares memory with the supervisory computer. Operator consoles are located on a serial highway; control is by means of a console CRT, trackball, and assignable shaft encoders and meters. Two identical consoles operate simultaneously: one is located in the tandem control room; the other is located in the cyclotron control room to facilitate operation during injection of tandem beams into the cyclotron or when beam lines under control of the cyclotron control system are used. The supervisory computer is used for accelerator parameter setup calculations, actual accelerator setup for new beams based on scaled, recorded parameters from previously run beams, and various other functions. Nearly seven years of control system operation and improvements will be discussed. DOE

**N86-23291#** Computer Resources International A/S (Denmark).
**STUDY OF HIGH THROUGHPUT CONCATENATED DECODER ASSESSMENT**
J. Justesen, (Technical Univ. of Denmark, Copenhagen), E. Paaske, (Technical Univ. of Denmark, Copenhagen), T. Ruebner-Petersen, (Technical Univ. of Denmark, Copenhagen), G. Berliner, and K. K. Pedersen Paris ESA 26 Mar. 1985 103 p
(Contract ESTEC-5874/84-D-DK(SC))
(CRI/RSS/REPO/003; ESA-CR(P)-2090) Avail: NTIS HC A06/MF A01

Ways of increasing the speed performance of the Reed-Solomon-Viterbi-Decoder (RSVD) concatenated decoder system of the Giotto mission to reach a net data rate of 1 Mbit/sec were investigated. All parts of the RSVD decoder subsystem that need to be redesigned were identified. Solutions required to reach the 1 Mbit/sec net data rate are proposed. Proposals for very high speed performance, 10 Mbit/sec net data rate and above, are also given. Only a moderate additional cost is required to implement a 10 Mbit/sec decoder subsystem. Author (ESA)

**N86-23292#** Rijkswaterstaat, The Hague (Netherlands). Dienst Informatieverwerking.
**REPORT MICROS 03 [RAPPORTAGE MICROS 03]**
J. vanDomselaar and C. G. Langereis 7 Oct. 1985 48 p
(AD-1985-1521; B8575102) Avail: NTIS HC A03/MF A01

An inventory of standard microcomputer software to be used in the Dutch Ministry of Public Works is presented. Software environment for the integration of the systems, and data exchange between different systems are discussed. Author (ESA)

**N86-23293#** Joint Publications Research Service, Arlington, Va.
**USSR REPORT: CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY**
20 Mar. 1986 66 p refs Transl. into ENGLISH from various Russian articles
(JPRS-UCC-86-003) Avail: NTIS HC A04/MF A01

Progress is reported in U.S.S.R. cybernetics, computers and automation technology. Specific topics discussed include: hardware; software; applications; computer networks; and theory of computations. For individual titles, see N86-23294 through N86-23310.

**N86-23294#** Joint Publications Research Service, Arlington, Va.
**KARL-3 SYSTEM FOR AUTOMATED DESIGN OF PRINTED-BOARD CIRCUITS Abstract Only** **c61**
I. G. Vintinzenko, I. G. Malykh, and Yu. F. Mirnykh *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 1 Transl. into ENGLISH from Avtomatizirovannyye Sistemi Upravleniya i Pribory Avtomatiki Vypusk 70 (Kharkov, USSR), 1984 p 93-99 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

Analysis of several computer-aided design systems led to the development of several versions of the compact and efficient KARL design system, which can be used on any YeS computer larger than the YeS-1020 with storage of at least 256 kbytes and MFT 4.1, MVT 4.1 and MVT 6.1 operating systems. The set of program modules is under the control of a monitor program in high-level PL/1 language and can be further developed and enlarged if necessary. There are no limitations on the dimensions of the boards or spacing of locations of elements and positioning on both sides or other circuit factors such as connections. Up to 500 designs can be handled simultaneously. The designer begins with a sketch of the design using groups of elements and the data base supplies necessary information as to elements and factors for further development while sketches are also printed out. The final output is a completed design. Documentation is also generated as well as punched control tape for photomask fabrication and execution of drilling by numerical control methods for the actual production of the boards. The KARL-3 is oriented towards a batch system of operation while the KARL-3T is preferable for dialogue mode work. Dynamic memory distribution is used. Author

**N86-23295#** Joint Publications Research Service, Arlington, Va.
**MODEL OF MULTIPROGRAM OPERATION IN NONHOMOGENEOUS COMPUTER SYSTEM WITH STRICT MEMORY DIVISION Abstract Only** **c62**
V. A. Vishnyakov and O. V. German *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 2 Transl. into ENGLISH from Avtomatika i Vychislitelnaya Tekhnika (Riga, USSR), no. 3, May - Jun. 1985 p 58-64 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

A computer network combines N nonhomogeneous computers with their own main memory. The system runs a batch of programs represented by a directed graph having a specified set of points and lines, where each point corresponds to a particular program module. Each computer can parallel process the current module and execute data input/output. The computer can start the processing of the next module if certain conditions are met. The control supervisor must plan the order of execution of the modules for each computer so that the generated schedules satisfy a minimum time requirement. The supervisor performs two functions: reduces time losses due to the waiting for the completion of I/O operations to a minimum and reduces time losses occasioned by nonoptimal planning of the graph with unweighted lines to a minimum. Some 20 examples were calculated for N = 2, 3, 4. The time requirement averaged 9.8% more than the optimal figure with the maximum time excess being 27.2%. The optimal results was achieved in 9 cases. The proposed model can be used in setting the supervisory for applied modules in computer scheduling problems. Author

**N86-23296#** Joint Publications Research Service, Arlington, Va.
**SIMULATION AND ANALYSIS OF CHARACTERISTICS OF DISTRIBUTED MULTIPROCESSOR SYSTEMS Abstract Only**
E. O. Akhmedov, A. A. Dzhavadov, S. F. Ismaylov, and B. G. Ismaylov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 2 Transl. into ENGLISH from Avtomatika i Vychislitelnaya Tekhnika (Riga, USSR), no. 3, May - Jun. 1985 p 70-75 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

A communications line delivers an input message flow to a supervisory microprocessor that is tied to an interface bus. An arbitrary number of homogeneous peripheral microprocessors and an input/output peripheral are also coupled to the bus. The supervisory microprocessor coordinates the real time operation of the system. It is necessary to assure a minimum loss of information with the minimum requisite system performance. This paper treats the microprocessor system as a single phase queuing configuration and determines the system efficiency in terms of the mean value of the probability of delay losses or losses due to system overloading. Expressions are found for the number of input claims, L sub q, awaiting servicing in three cases: for exponential, constant and Erlang servicing time. A graph is shown for these three cases (assuming a Poisson input flow) using the results of YeS-1022 computer simulation and shows L sub q as a function of the number of microprocessors. Author

**N86-23297#** Joint Publications Research Service, Arlington, Va.
**SM-1810 DOMESTIC PERSONAL COMPUTERS AND DIALOG COMPUTER COMPLEX**
Boris Mikhaylovich Rudzitskiy *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 3-4 Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhnike: Seriya Radioelektronika i Svyaz (Moscow, USSR), no. 8, Sep. 1985 p 46-47 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

According to the designers' intentions, each type of personal computer should be developed and manufactured as a series of machines differing in the potentialities and nomenclature of external devices and in the capability for application to the solution of problems of various classes. The most powerful computer for the dialog computer complex series with developed functional potentialities is the Elektronika NTs 80-20/3. It represents a highly integrated desk computer. This is basic hardware intended for application in systems of data management and data processing, mathematical modeling and statistical analysis, and to engineering calculations and designing, and also in computer networks with complicated structure. The machine includes the following: a single-board Elektronika NTs 80-01D microcomputer the base, and other personal computers of this series; a video display graphic monitor; a thermal printing device; a keyboard; a floppy disc unit; and a plotter. This paper outlines the basic characteristics of the Elektronika NTs 80-20/3. B.W.

**N86-23298#** Joint Publications Research Service, Arlington, Va.
**CONCEPT OF AUTOMATED MACRODESIGN OF NETWORKS OF AUTOMATED CONTROL SYSTEMS Abstract Only** **c63**
Yu. Yu. Kess *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 5 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (Kiev, USSR), no. 3, May - Jun. 1985 p 7-11 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

Because of the increasing complexity of automated control systems (ASU), automated design systems must be replaced by automated macrodesign systems (SAMP) based on a modular and hierarchical concept of ASU networks. The control metaobject is the hierarchical aggregate of homogeneous design objects (for example, the motor transport equipment of a republic). The ASU and its modular components are synthesized by SAMP man/machine procedures and the designs must not depend on the actual realizations. The artificial intelligence concept of frame is applied to the design of the modules and macroelements are represented and manipulated on design screens with recourse to procedures which have results which cannot be predicted by users and the resulting designs are stored in libraries. Various users can work independently while a chief engineer solves conflicts. The SAMP system is also supposed to automatically produce and update technical documentation but problems have been encountered in the realization. An experimental SAMP was built using the PRIZ interactive development program system which utilizes semantic modules and the UTOPIST problem-oriented language. Author

**N86-23299#** Joint Publications Research Service, Arlington, Va.
**VECTOR COMPUTATION PROGRAM SYSTEM Abstract Only** **c61**

V. P. Razbegin, G. N. Kalyanov, and B. V. Kupriyanov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 6 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 4, Jul. - Aug. 1983 p 25-32 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

This study describes the VEKTOR procedural programming language, in which programs, procedures, and functions are the fundamental program units. Procedures and functions can be embedded, or can comprise autonomous modules. The language supports arithmetic and Logical VECTOR*VECTOR, SCALAR*VECTOR, and VECTOR*SCALAR element operations, convolution over a series of element operations, ANY and ALL quantors for logical vectors, and left and right cyclic shift operators. The VEKTOR programming system is designed to support software complexes for the PS-2000 in high-level VEKTOR language and PPS-2000 microcode, the configuration of program complexes, and linking of SM-2 applications programs with PPS-2000 programs, as well as PPS-2000 programming debugging in terms of the VEKTOR language. The features of the VEKTOR compiler, statistical analyzer, standard microprogram library, Sm-2 interaction control program library, and debugger are described. All of the programs making up the programming system comprise approximately 80,000 conventional instructions; the system has been in operation since early 1983, and has increased programming productivity 10 to 12-fold as compared with programming in lower level languages. Author

**N86-23300#** Joint Publications Research Service, Arlington, Va.
**SYSTEM OF AUTOMATED TESTING FOR MIXAL PROGRAMS Abstract Only** **c61**

V. L. Katkov and G. V. Yermakov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 6-7 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 3, May - Jun. 1985 p 50-58 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

MIXAL is a component of the MIX system and is used for teaching assembly programming. The principles are presented for the testing (as distinguished from the later debugging procedures) of the programs. In the MIX system testing is carried out in accord with a criterion for workable program transitions and is oriented toward automatic execution. Testing is carried out in batch rather than dialogue mode and the tests are stored in a library for repetitions and consultations. Automated testing is executed by the Avtotest subsystem which is part of the MIX system and the MIXAL program to be tested must be compatible with the Avtotest format. The test procedure begins with the initialization section in which initial data (variables, etc.) are checked and is followed by the assertion section in which results due to ASRT (assert) operators using a higher-level language than the MIXAL autocode are verified. The Avtotest subsystem consists of a control program, programs for processing control operators and accessing data in MIX storage for initialization data, programs for searching for MIXAL programs in libraries and programs for processing assertion results which check program syntax. Author

**N86-23301#** Joint Publications Research Service, Arlington, Va.
**TRACING AND ANALYSIS OF COMPUTER SYSTEMS BY MEANS OF THE STAN PROGRAM Abstract Only** **c62**

Ya. A. Kogan and L. B. Kozinskiy *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 7-8 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 3, May - Jun. 1985 p 25-37 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

Monitors are used to evaluate loading of resources, system settings, and program performance, but system events for the three functions occur st different frequencies and this creates problems for the monitor whose operations may have a negative effect on computer operations. A tracing and analysis system (STAN) was developed for monitoring YeS computers involving mainly synchronous measurements but with some asynchronous operations. The system consists of tracing and analysis generators. The tracing generator performs interrupts for system monitoring and carries out priority commands and is an improvement on previous monitors since it can cover a brother spectrum of event frequencies. The special feature of STAN is that the control point values, which were set by the user in the operating system, can be monitored. Results are given for the application of STAN for three computer systems with different degrees of multiprogramming (M-4030 and YeS-1045 computers) and experimental applications are considered for raising productivity and studying the behavior of programming whose effectiveness is linked to the relative proximity in space and time in various forms of memory of data required by program commands. Author

**N86-23302#** Joint Publications Research Service, Arlington, Va.
**ON THE THEORY OF OVERALL STORAGE ECONOMY Abstract Only**

N. A. Vasilyev *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 8 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 3, May - Jun. 1985 p 82-85 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

Overall storage economy was treated by a theory linking memory economy and the coloring of the nodes of a graph for equal weighted statistical variables (scalars) for the class of closed operational circuits and standard circuits and which involves ordered colorings for these variables and the construction of memory distribution axiomatics (Lavrov-Yershov theory). For a given program there is a standard circuit consisting of a transition graph whose nodes are operators and the branches determine the transition of control from one operator to another between which are information links in which results from one operator become the argument of another. Correct memory distribution implies that there will be a single value for results and arguments in each data link. Data link routing requires transmission of a value along a single link and leads to the formation of a data graph whose edges and nodes can be treated as a coloring problem determining optimal ordering of the data organization for the initial program. It is proposed to extend this concept to the case of data groups considered as vectors which have weights greater than the scalars and are oriented with respect to memory addresses in a forward or backward directions. Author

**N86-23303#** Joint Publications Research Service, Arlington, Va.
**GRAPH-TEXT CODING OF ALGORITHMS Abstract Only** **c61**

V. A. Zhizhko *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 9 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 3, May - Jun. 1985 p 14-24 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

The problem considered is the improvement of the transformation of the two-dimensional graphic scheme into the linear sequence of symbols constituting the textural representation of the algorithm. The transformation (or coding) of the flowchart into the text is a routine process which does not require high qualifications and tends to be automated. An R-code procedure is available which produces structures isomorphic to the flowchart and uses a special translation language (R/TRAN). The usual computer symbols are used to reproduce the flowchart shapes by running together strings of characters resembling graph forms. The paper proposes an improvement (S-code) of the method with a more detailed breakdown of graph forms for reproduction by computer characters. The result is an S-graph which is translated into the object language (whether of FORTRAN or ALGOL types) by a program run in a preprocessor based on the node and edge structure of the graph. Certain problems in the establishment of the S-graphs are due to limits on the possible line dimensions of the computer input

which are dealt with by special constructions or sub-graphs.
Author

**N86-23304#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF DIALOGUE MODE MICROCOMPUTER PROGRAMMING USING YeS COMPUTERS Abstract Only c61**
A. A. Ilyukovich and V. Yu. Bobolovich *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 9-10 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (Kiev, USSR), no. 3, May - Jun. 1985 p 34-36 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

Microcomputers are increasingly used in integrated automated control systems and in processing networks, resulting in additional program needs. However, problems arise because of the small memories, limited operating systems and insufficient peripherals of the microcomputers in comparison with YeS computer resources. A cross-system utilizing large computer programs for preparing programs for the Elektronika-60 and other mini- and microcomputers of this architecture was developed. It operates on the YeS computer with a version 6.1 YeS operating system. The cross-system consists of a cross-translator and assembler, linkage editor, data set converter program, debugger and dialogue mode control program. The generated operating system has a telecommunication access component. Programs can be prepared in dialogue mode on YeS 7920 displays by eight users simultaneously on a time sharing basis. System operators and procedures are described. Experience showed that the YeS computer was most effectively used if there were six to eight simultaneous users. Author

**N86-23305#** Joint Publications Research Service, Arlington, Va.
**ORGANIZATION OF A SINGLE SHARED EXTERNAL MEMORY FOR AUTOMATED DESIGN SYSTEM Abstract Only**
S. N. Grishchenko, A. O. Ulybin, and V. A. Finikov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 10 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (Kiev, USSR), no. 3, May - Jun. 1985 p 42-46 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

A shared memory system is described for the BESM-6 computer involving dynamic distribution among users of memory space on tapes and discs with access to storage only through the system. The shared memory consists of system and user space with system space making up only .4% of the volume. Users are divided into groups and each group is dynamically assigned a certain space for a task in a manner compatible with the Dubna operating system. Spaces can be moved and regrouped. Procedures for control and optimization of space use are described. The system was realized in the form of 296 modules in MADLEN autocode in FORTRAN-GDR with a volume of about 60,000 BESM-6 commands. There must be a resident store. When the system is set up it is possible to set the main parameters, i.e, maximum number of tasks which can be handled simultaneously; maximum number of spaces available to user; maximum number of magnetic tapes or discs which can be accessed simultaneously. The monitor program occupies 52 storage cells. The system space has permanent and temporary statistical and dynamic tables which are constructed with sequential, index-sequential, direct, tree, list and stack organizations. Author

**N86-23306#** Joint Publications Research Service, Arlington, Va.
**RIS SYSTEM FOR COMPUTER-AIDED PREPARATION OF GRAPHIC DOCUMENTATION Abstract Only c61**
V. L. Katkov, A. Ye. Khlebtsevich, and A. I. Bliznets *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 11 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (Kiev, USSR), no. 3, May - Jun. 1985 p 74-77 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

The RIS system was developed for handling and introducing graphic material into computerized text editing. When the automated Strela text system encounters a graph the RIS system takes over and editing is possible from alpha-numeric keyboards. It utilizes primitives for composing the graphs and is largely independent of the type of computer used. RIS is oriented towards non-professional users and has a language close to natural Russian with word variations possible as to gender, number and case. Both text and graphs are in the form of alphanumeric sequences and both types of material can be handled simultaneously in batch or dialogue mode on standard displays. RIS was realized on YeS computers using SIPL-1 translator language and with OS YeS and PDO SVM YeS operating systems. After completion the RIS file is translated into a FORTRAN language GRAFOR graphic program or into a Calcomp magnetic tape file for the actual graphics output generation greater portability. Author

**N86-23307#** Joint Publications Research Service, Arlington, Va.
**AUTOMATED DESIGN OF PROGRAMS FOR DATA BASE MANAGEMENT IN TELEPROCESSING MODE Abstract Only**
Yu. B. Sytina, L. A. Gendelman, and I. A. Saprykina *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 11-12 Transl. into ENGLISH from Avtomatizirovannyye Sistemy Uprvaleniya i Pribory Avtomatiki Vypusk 70 (Kharkov, USSR), 1984 p 60-64 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

A data teleprocessing system was developed for YeS-7920 terminal data representation equipment consisting of a set of application programs each using the KAMA control system with time sharing. Each system carries out a function and tasks by means of the KAMA system which does not, however, have the necessary command functions which are supplied by the application programs. By means of a standard application package, standard facilities were created for the handling of data files including screen functions, query formats, data distribution on screen, dialogue facilities and the file processing algorithm, making it possible to automate application operations for the processing of sequential and index-sequential files and for realizing data input, searching and scanning, and correction. The program generation part of the package has a set of programs for generating programs for file processing and a group containing function generators implementing data handling. Each generator has a starting module into which the user loads data using assembly language with later translation and editing. The reason for the creation of the separate programs for various functions is that the KAMA system cannot productively handle programming requiring large data volumes.
Author

**N86-23308#** Joint Publications Research Service, Arlington, Va.
**THE DEVELOPMENT OF AN IDENTIFIER SYSTEM FOR ELEMENTS OF A PRODUCTION SYSTEM ON THE SCALE OF AN ENTERPRISE**
V. Ya. Sedush, G. V. Sopilkin, N. A. Chentsov, and V. I. Isayenko *In its* USSr Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 13-17 ref Transl. into ENGLISH from Klassifikatory i Dokumenty (Moscow, USSR), no. 7, Jul. 1985 p 25-29 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

A technological system in an enterprise is a complex of mechanical, electrical, electronic and other equipment. The contemporary trend towards improving equipment requires solving a different set of problem for each component in the technological system, all the way down to a nut or bolt. Therefore, devising codes for all equipment parts is necessary. In connection with the requirements of the equipment maintenance tasks, a coding system for identifying the parts in a technological system of an enterprise was designed. A technological system of an enterprise has six levels: (1) technological system proper-S (blooming mills, power system); (2) subsystem of the technological system-P (mechanical, electrical); (3) machine-M (an element of the subsystem, shearing machine and distribution device of 3 kilovolt); (4) unit-U (a part of the machine crank, tire); (5) part-D (bearing, insulator);

(6) hardware-fasteners-Ye (key, bolt). The complete nomenclature for the technological system consists of a code for every element at each level element at each level in the hierarchy. By an identifying code, the location of an element in the technological system and be defined. Author

**N86-23309#** Joint Publications Research Service, Arlington, Va.
**PROGRAMMABLE HAND CALCULATORS IN AVIATION SPORT**
A. Romanyuk *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 18-23 Transl. into ENGLISH from Krylya Rodiny (Moscow, USSR), no. 7, Jul. 1985 p 15-16 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

This research proposes that the MK-54 programmable hand calculator be used as a computer that calculates the points of participants in glider competitions. The cost of this and similar calculators (MK-56, BZ-34) varies between 50 and 100 rubles. The calculators feature a simple programming system, are easy to use and can muster most of the computational power required. It can execute point calculations in different glider class competitions when draws occur both in speed and distance competitions for any combination of finishers. The set-up time to run the calculations is less than 5 minutes, and the time required to calculate the results of one participant is less than 12 seconds. The program has been used in judging oblast competitions. A simplified flow chart of the algorithm used is presented, and a chart of the addressed registers is given. Author

**N86-23310#** Joint Publications Research Service, Arlington, Va.
**FLEXIBLE PRODUCTION SYSTEMS AND THE DEVELOPMENT OF METHODS FOR THEIR CONTROL** **c63**
A. M. Voychinskiy *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 27-35 refs Transl. into ENGLISH from Standarty i Kachestvo (Moscow, USSR), no. 8, Aug. 1985 p 18-21 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

The creation of flexible production systems (GPS) makes it possible to successfully perform the task of increasing the efficiency of social production, when the entire chain of processes, from product design by means of CAD systems (SAPR) and automated systems for production engineering (ASTPP), to the control of the industrial process by means of ASUTP, to the control of production as whole. The control of automated production is accomplished with a four-level control system: the first (based on microprocessor equipment) controls each machine position, industrial robot, intermediate operational storage, and the sequence and nature of operations in order to attain the specified component form, dimensions and quality; the second (based on the Elktronika-80 microcomputer) controls a multifunctional robot configuration (RIK) or group of single-function automata along with their attendent storage and transport robots (robotized area); the third (based on the SM-4) controls production; and the fourth (based on the YeS computer and enterprise ASU) controls planning and system material and technical supply (MTO). Necessary conditions for the design and reliable, effective operations of flexible production systems are described in detail. Author

**N86-22757#** Joint Publications Research Service, Arlington, Va.
**DESIGN OF NEW SYSTEM ARCHITECTURE WITH HYBRID REDUNDANCY (HCC)**
Tongzhao Chen *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 123-131 refs Transl. into ENGLISH from Jisuanji Xuebao (Beijing, China), v. 8, Jul. 1985 p 314-320 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22770#** Joint Publications Research Service, Arlington, Va.
**NEW PLA, ITS OPTIMIZATION ALGORITHM FOR COMPUTER-AIDED DESIGN**
Chunhe Liu *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 86-98 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 11, no. 4, Jul. 1983 p 52-60 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

**N86-22817#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
**EXPERIMENTAL ON-BOARD PROCESSING PAYLOAD FOR ADVANCED COMMUNICATIONS SATELLITE**
O. B. Millies-Lacroix *In its* Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 47-49 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

# 61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

**N86-23311** Northwestern Univ., Evanston, Ill.
**AN APPROACH TO SOFTWARE RAPID PROTOTYPING Ph.D. Thesis**
Yen-Chou Chou 1985 176 p
Avail: Univ. Microfilms Order No. DA8523506

Rapid prototyping refers to the techniques to produce a software prototype early during the software life cycle and at low cost. The motivation of this study is due to the problem that the user and the designer are unable to understand and to verify the requirements specification whether the software system specified satisfies the real need. By examining a prototype, both the user and the designer can have better idea about what the requirements of the desired software system are and thus the total development cost is reduced. In this dissertation, an approach to produce a software prototype is presented. First, the requirement specification is transformed to a requirements model. In this model, the requirements of the software system are represented as a set of interconnected components, in which the control flow, the data flow and the data structures are defined. The requirements model is then transformed into a code skeleton of the target programming language by a set of transformation steps. The informal description left in code skeleton is then translated to code using a modified syntax-directed translation scheme. Dissert. Abstr.

**N86-23312** National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
**A PASCAL IMPLEMENTATION OF THE RSA ALGORITHM**
A. A. Aruliah Sep. 1985 35 p refs
(NPL-DITC-66/85; ISSN-0262-5369) Copyright. Avail: Issuing Activity

The RSA algorithm, a public key cryptographic technique, is introduced. Although mathematically straightforward, the algorithm involves multilength integer calculation which is complex to program in a high level language. The PASCAL version presented allows more widespread use of the method. Author (ESA)

**N86-23313#** Royal Armament Research and Development Establishment, Fort Halstead (England).
**A METHOD FOR THE DEVELOPMENT OF SIMULATIONS**
M. R. Krick Mar. 1985 187 p refs
(RARDE-22/84; BR95245) HC A09/MF A01

A method for the development and maintenance of large computer simulations of the type used in operational research assessment tools is described. The method is based on a variant of the Jackson System Development methodology. The potential use of the Ada language as a means of implementation is discussed. Author (ESA)

**N86-23314*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SPACE STATION SOFTWARE RECOMMENDATIONS**
Susan Voigt, ed. Dec. 1985 142 p refs Forum held in Huntsville,

Ala., 24-25 Apr. 1985
(NASA-CP-2394; L-16063; NAS 1.55:2394) Avail: NTIS HC A07/MF A01 CSCL 09B

Four panels of invited experts and NASA representatives focused on the following topics: software management, software development environment, languages, and software standards. Each panel deliberated in private, held two open sessions with audience participation, and developed recommendations for the NASA Space Station Program. The major thrusts of the recommendations were as follows: (1) The software management plan should establish policies, responsibilities, and decision points for software acquisition; (2) NASA should furnish a uniform modular software support environment and require its use for all space station software acquired (or developed); (3) The language Ada should be selected for space station software, and NASA should begin to address issues related to the effective use of Ada; and (4) The space station software standards should be selected (based upon existing standards where possible), and an organization should be identified to promulgate and enforce them. These and related recommendations are described in detail in the conference proceedings. For individual titles, see N86-23315 through N86-23318.

**N86-23315*#** National Aeronautics and Space Administration, Washington, D.C.
**SPACE STATION: THE ROLE OF SOFTWARE**
Dana Hall *In* NASA. Langley Research Center Space Station Software Recommendations Dec. 1985 p 3-38 (For primary document see N86-23314 13-61)
Avail: NTIS HC A07/MF A01 CSCL 09B

Software will play a critical role throughout the Space Station Program. This presentation sets the stage and prompts participant interaction at the Software Issues Forum. The presentation is structured into three major topics: (1) an overview of the concept and status of the Space Station Program; (2) several charts designed to lay out the scope and role of software; and (3) information addressing the four specific areas selected for focus at the forum, specifically: software management, the software development environment, languages, and standards. NASA's current thinking is highlighted and some of the relevant critical issues are raised. Author

**N86-23316*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A VIEW OF SOFTWARE MANAGEMENT ISSUES**
John H. Manley (Computing Technology Transition, Inc.) *In its* Space Station Software Recommendations Dec. 1985 p 39-83 (For primary document see N86-23314 13-61)
Avail: NTIS HC A07/MF A01 CSCL 09B

The Software Development Environment (SDE) Panel addressed key programmatic, scope, and structural issues raised by its members and the general audience regarding the proposed software development environment for the Space Station program. The general team approach taken by this group led to a consensus on 18 recommendations to NASA mangament regarding the acquisition and definition of the SDE. This approach was keyed by the initial issues presentation given to the general audience. Additional issues (for a total of 23) were developed by the panelists in their first closed session from which key areas were selected and discussed in open session. These discussions led to key recommendations which are summarized and described. Author

**N86-23317*#** TRW, Inc., Cleveland, Ohio.
**A VIEW OF SOFTWARE DEVELOPMENT ENVIRONMENT ISSUES**
Barry Boehm *In* NASA. Langley Research Center Space Station Software Recommendations Dec. 1985 p 84-117 (For primary document see N86-23314 13-61)
Avail: NTIS HC A07/MF A01 CSCL 09B

The unique and challenging nature of the Space Station Program requires that software standards be effectively used to control costs, facilitate enhancements and ensure safety. The Software Standards Panel identified and developed recommendations in four areas to help the Space Station Program achieve these objectives. The areas in which recommendations are offered are policy, organization, process and candidate software standards for the Space Station Program. The concensus process employed by the panel is given and recommendations are made. Author

**N86-23318*#** Tektronix, Inc., Beaverton, Oreg.
**NASA SPACE STATION SOFTWARE STANDARDS ISSUES**
George D. Tice, Jr. *In* NASA. Langley Research Center Space Station Software Recommendations Dec. 1985 p 118-131 refs (For primary document see N86-23314 13-61)
Avail: NTIS HC A07/MF A01 CSCL 09B

The selection and application of software standards present the NASA Space Station Program with the opportunity to serve as a pacesetter for the United States software in the area of software standards. The strengths and weaknesses of each of the NASA defined software standards issues are summerized and discussed. Several significant standards issues are offered for NASA consideration. A challenge is presented for the NASA Space Station Program to serve as a pacesetter for the U.S. Software Industry through: (1) Management commitment to software standards; (2) Overall program participation in software standards; and (3) Employment of the best available technology to support software standards Author

**N86-23319*#** Research Triangle Inst., Research Triangle Park, N.C.
**DISPLAY SYSTEM SOFTWARE FOR THE INTEGRATION OF AN ADAGE 3000 PROGRAMMABLE DISPLAY GENERATOR INTO THE SOLID MODELING PACKAGE C.A.D. SOFTWARE Contractor Report, 26 Sep. 1984 - 31 Mar. 1986**
R. J. Montoya and H. H. Lane, Jr. Mar. 1986 159 p refs (Contract NAS1-17890)
(NASA-CR-178065; NAS 1.26:178065; RTI/3052/00-01F) Avail: NTIS HC A08/MF A01 CSCL 09B

A software system that integrates and ADAGE 3000 Programmable Display Generator into a C.A.D. software package known as the Solid Modeling Program is described. The Solid Modeling Program (SMP) is an interactive program that is used to model complex solid object through the composition of primitive geomeentities. In addition, SMP provides extensive facilities for model editing and display. The ADAGE 3000 Programmable Display Generator (PDG) is a color, raster scan, programmable display generator with a 32-bit bit-slice, bipolar microprocessor (BPS). The modularity of the system architecture and the width and speed of the system bus allow for additional co-processors in the system. These co-processors combine to provide efficient operations on and rendering of graphics entities. The resulting software system takes advantage of the graphics capabilities of the PDG in the operation of SMP by distributing its processing modules between the host and the PDG. Initially, the target host computer was a PRIME 850, which was later substituted with a VAX-11/785. Two versions of the software system were developed, a phase 1 and a phase 2. In phase 1, the ADAGE 3000 is used as a frame buffer. In phase II, SMP was functionally partitioned and some of its functions were implemented in the ADAGE 3000 by means of ADAGE's SOLID 3000 software package. Author

**N86-23320*#** Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
**DEVELOPMENT OF COMPUTER PROGRAM NAS3D USING VECTOR PROCESSING FOR GEOMETRIC NONLINEAR ANALYSIS OF STRUCTURES Final Report, 20 Sep. - 31 Dec. 1985**
P. D. Mangalgiri and R. Prabhakaran Jan. 1986 44 p refs (Contract NAS1-17993)
(NASA-CR-176707; NAS 1.26:176707) Avail: NTIS HC A03/MF A01 CSCL 09B

An algorithm for vectorized computation of stiffness matrices of an 8 noded isoparametric hexahedron element for geometric nonlinear analysis was developed. This was used in conjunction with the earlier 2-D program GAMNAS to develop the new program NAS3D for geometric nonlinear analysis. A conventional, modified Newton-Raphson process is used for the nonlinear analysis. New

schemes for the computation of stiffness and strain energy release rates is presented. The organization the program is explained and some results on four sample problems are given. The study of CPU times showed that savings by a factor of 11 to 13 were achieved when vectorized computation was used for the stiffness instead of the conventional scalar one. Finally, the scheme of inputting data is explained. Author

**N86-23321*#** Stanford Univ., Calif. Center for Reliable Computing.
**DYNAMIC ASSERTION TESTING OF FLIGHT CONTROL SOFTWARE**
Dorothy M. Andrews, Aamer Mahmood, and Edward J. McCluskey Jul. 1985 25 p refs
(Grant NAG2-246)
(NASA-CR-176715; NAS 1.26:176715; SU-HICSS-19) Avail: NTIS HC A02/MF A01 CSCL 09B

Digital Flight Control System (DFCS) software was used as a test case for assertion testing. The assertions were written and embedded in the code, then errors were inserted (seeded) one at a time and the code executed. Results indicate that assertion testing is an effective and efficient method of detecting errors in flight software. Most errors are eliminate at an earlier stage in the development than before. B.G.

**N86-23322*#** Stanford Univ., Calif. Center for Reliable Computing.
**DYNAMIC ASSERTION TESTING OF FLIGHT CONTROL SOFTWARE**
Dorothy M. Andrews, Aamer Mahmood, and Edward J. McCluskey Jul. 1985 25 p refs Submitted for publication
(Grant NAG2-246)
(NASA-CR-176712; NAS 1.26:176712) Avail: NTIS HC A02/MF A01 CSCL 09B

Assertions are used to dynamically test fault tolerant flight software. The experiment showed that 87% of typical errors introduced into the program would be detected by assertions. Detailed analysis of the test data showed that the number of assertions needed to detect those errors could be reduced to a minimal set. The analysis also revealed that the most effective assertions tested program parameters that provided greater indirect (collateral) testing of other parameters. Author

**N86-23323*#** Stanford Univ., Calif. Center for Reliable Computing.
**A METHODOLOGY FOR TESTING FAULT-TOLERANT SOFTWARE**
Dorothy M. Andrews, Aamer Mahmood, and Edward J. McCluskey Nov. 1985 26 p refs
(Grant NAG2-246)
(NASA-CR-176713; NAS 1.26:176713; SU-CRC-TR-85-22; SU-CSL-TN-85-282) Avail: NTIS HC A03/MF A01 CSCL 09B

A methodology for testing fault tolerant software is presented. There are problems associated with testing fault tolerant software because many errors are masked or corrected by voters, limiter, or automatic channel synchronization. This methodology illustrates how the same strategies used for testing fault tolerant hardware can be applied to testing fault tolerant software. For example, one strategy used in testing fault tolerant hardware is to disable the redundancy during testing. A similar testing strategy is proposed for software, namely, to move the major emphasis on testing earlier in the development cycle (before the redundancy is in place) thus reducing the possibility that undetected errors will be masked when limiters and voters are added. Author

**N86-23324*#** Stanford Univ., Calif. Center for Reliable Computing.
**THE WATCHDOG TASK: CONCURRENT ERROR DETECTION USING ASSERTIONS**
Aydin Ersoz, Dorothy M. Andrews, and Edward J. McCluskey Jul. 1985 65 p refs
(Grants NAG2-246; NSF DCR-82-00129)
(NASA-CR-176714; NAS 1.26:176714; SU-CRC-TR-85-8; SU-CSL-TR-85-267) Avail: NTIS HC A04/MF A01 CSCL 09B

The Watchdog Task, a software abstraction of the Watchdog-processor, is shown to be a powerful error detection tool with a great deal of flexibility and the advantages of watchdog techniques. A Watchdog Task system in Ada is presented; issues of recovery, latency, efficiency (communication) and preprocessing are discussed. Different applications, one of which is error detection on a single processor, are examined. Author

**N86-23325*#** Stanford Univ., Calif. Center for Reliable Computing.
**DYNAMIC ASSERTION TESTING OF FLIGHT CONTROL SOFTWARE**
Dorothy M. Andrews, Aamer Mahmood, and Edward J. McCluskey Aug. 1985 25 p refs
(Grant NAG2-246)
(NASA-CR-176716; NAS 1.26:176716; SU-CRC-TR-85-15; SU-CSL-TN-85-274) Avail: NTIS HC A02/MF A01 CSCL 09B

An experiment in using assertions to dynamically test fault tolerant flight software is described. The experiment showed that 87% of typical errors introduced into the program would be detected by assertions. Detailed analysis of the test data showed that the number of assertions needed to detect those errors could be reduced to a minimal set. The analysis also revealed that the most effective assertions tested program parameters that provided greater indirect (collateral) testing of other parameters. Author

**N86-23326#** Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
**PRISM TREES: AN EFFICIENT REPRESENTATION FOR MANIPULATING AND DISPLAYING POLYHEDRA WITH MANY FACES**
Jean Ponce Apr. 1985 23 p
(Contracts N00014-80-C-0505; N00014-77-C-0389)
(AD-A162601; AI-M-838) Avail: NTIS HC A02/MF A01 CSCL 12/1

Computing surface and/or object intersections is a cornerstone of many algorithms in geometric and modelling computer Graphics, for example set operations between solids, or surfaces ray casting display. This document presents an object centered, information preserving, hierarchical representation for polyhedra called Prism Tree. The author uses the representation to decompose the intersection algorithms into two steps: the localization of intersections, and their processing. When dealing with polyhedra with many faces (typically more than one thousand), the first step is by far the most expensive. The Prism Tree structure is used to compute efficiently this localization step. A preliminary implementation of the Set operations and ray casting algorithms has been constructed. Author (GRA)

**N86-23327#** Stanford Univ., Calif. Dept. of Operations Research.
**THEORY ON EXTENDING ALGORITHMS FOR PARAMETRIC PROBLEMS**
B. C. Eaves and U. G. Rothblum Aug. 1985 100 p refs
(Contract DE-AS03-76ER-72018)
(DE86-002068; SOL-85-13) Avail: NTIS HC A05/MF A01

Given certain algorithms for certain problems, these algorithms can be encorporated in a lift, solve, and lower sequence to form algorithms for solving parametric versions of the problems. In the first phase of the sequence the parametric problem is lifted to an extended ordered field where it becomes a single problem, that is, nonparametric. Second, the original algorithm is run in the extended ordered field to solve the single problem. Finally, this solution to the single problem is lowered to the original ordered field to obtain a parametric solution to the original parametric problem. DOE

**N86-23328#** Oak Ridge National Lab., Tenn.
**ROOTS: A PROGRAM TO GENERATE RADIONUCLIDE DECAY CHAINS**
D. E. Fields and D. E. Dunning, Jr. Nov. 1985 41 p refs
(Contract DE-AC05-84OR-21400)

(DE86-002572; ORNL/TM-9452) Avail: NTIS HC A03/MF A01

A set of algorithms has been developed to support dosimetric and transport calculations. These subroutines read a radionuclide data file and prepare a decay chain showing branching fractions and radioactive half-lives of each member. One application of these subroutines has been their implementation as a set of FORTRAN subroutines for application in the PREREM code (Ryan and Fields, 1981). Recent use of these subroutines in stand-alone form required their expansion to print branching fractions. An expanded data set based on ICRP-38 radionuclide data (ICRP, 1983) was also prepared. This subroutine package is called Radionuclide Origin and Ontogeny Tracing Subroutines (ROOTS). The package is intended for execution on a Digital Equipment Corporation PDP-10 Computer System, and may require modification to run on other machines. DOE

**N86-23329#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
**AUTOMATION OF A REMOTE FIBER FLUORIMETRY SYSTEM**
R. A. Malstrom and B. C. Osgood 1985 25 p Presented at the 12th Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Philadelphia, Pa., 29 Sep. 1985
(Contract DE-AC09-76SR-00001)
(DE86-001970; DP-MS-85-70; CONF-8509157-4) Avail: NTIS HC A02/MF A01

The development of software for a multitasking computer to automate a remote analytical technique called remote fiber fluorimetry (RFF) will be discussed. The RFF system includes a Nd:YAG laser, fiber optics, a multiplexer, and a gated, intensified, diode-array detector. The system is designed to measure multi-wave-length time-resolved fluorescence spectra from various remote sampling points via fiber optics. The requirements of the system include a user-friendly interface for operators, archiving of results and spectra, online debugging capability, and control of the system by multiple users without interference. The RFF instrumentation is totally computer controlled. This includes control and diagnostics of the laser; stepper motor control; and gating, spectral accumulation, and readout from the diode-array. The techniques used to implement this computer control are varied, and range from assembly language routines watching interrupt lines, to RS232 communications with intelligent subcontrollers. Multitasking was an efficient way to design software for the instrument. DOE

**N86-23330#** Sandia National Labs., Albuquerque, N. Mex.
**METHOD FOR INCORPORATING GAUSS' LAW INTO ELECTROMAGNETIC PIC CODES**
B. Marder Oct. 1985 17 p refs
(Contract DE-AC04-76DP-00789)
(DE86-002635; SAND-85-2051) Avail: NTIS HC A02/MF A01

An algorithm is presented which solves a modified set of Maxwell's equations, none of them elliptic, in an electromagnetic PIC type code. The algorithm prevents large violations of Gauss' law by diffusing away numerical errors arising from the particle-to-grid apportionment method. There are no restrictions on the manner in which charge and current densities are determined from the particle distribution. In particular, point particles and simple linear interpolation are used. DOE

**N86-23331#** National Bureau of Standards, Washington, D.C.
**NEW VERSION OF PTRACE, INTERNAL REPORT**
S. Penner 30 Jan. 1985 6 p
(Contract DE-AT01-79ER-10527)
(DE86-002848; DOE/ER-10527/T5) Avail: NTIS HC A02/MF A01

A modified version of PTRACE was created containing some features that are useful in ray tracing calculations for the NBS microtron. The modified version, called STRACE, will run with an input data deck from PTRACE, producing essentially the same results but with improved numerical accuracy and slightly faster computation time. The new features and the changes in input data needed to activate them are discussed. DOE

**N86-23332#** Oak Ridge National Lab., Tenn.
**LIFETIME: A COMPUTER PROGRAM FOR ANALYZING DOPPLER-SHIFT RECOIL-DISTANCE NUCLEAR LIFETIME DATA**
J. C. Wells, M. P. Fewell, and N. R. Johnson Oct. 1985 99 p refs
(Contract DE-AC05-84OR-21400)
(DE86-002903; ORNL/TM-9105) Avail: NTIS HC A05/MF A01

The program LIFETIME is designed to extract lifetimes of nuclear levels from Doppler-shift recoil-distance experiments by performing a least-square fit to the experimental data (shifted and unshifted photopeak intensities and branching ratios). Initial populations of levels and transition rates between levels are treated as variable parameters. In terms of these parameters the population of each level as a function of time is determined by the Bateman equations, and the shifted and unshifted intensities are calculated. DOE

**N86-23333#** Sandia National Labs., Albuquerque, N. Mex.
**ARIES DATA STRUCTURE FILE**
M. P. Sears May 1985 46 p
(Contract DE-AC04-76DP-00789)
(DE85-014341; SAND-85-0315) Avail: NTIS HC A03/MF A01

This paper describes version 2.0 of the ARIES data structure (ADS) file, and the subroutines used to access it. ADS files are very flexible neutral files which can be used in almost any finite element or finite difference data management application, including initial problem setup, cycle restart dumps, history and plot output, and even for internal data management. The ADS subroutine package is written in RATFOR, a pre-processed version of FORTRAN-77. The ADS files are hierarchically organized and may be accessed randomly, and the package supports multiple files. DOE

**N86-23334#** California Univ., Berkeley. Lawrence Berkeley Lab.
**OUTLINE OF A FAILURE: A TRUE STORY OF NINE PRECEPTS, WITH TWO MORALS**
D. F. Stevens Aug. 1985 7 p Presented at the 10th World Computer Congress, Dublin, Ireland, 1 Sep. 1986
(Contract DE-AC03-76SF-00098)
(DE86-000601; LBL-20084; CONF-860924-1) Avail: NTIS HC A02/MF A01

This is not a conventional case history. It is concerned with failure rather than with triumph, and further, with a personal definition of failure. Failure, like beauty, is in the eye of the beholder. The system I shall call SOS, when measured in terms of absolute achievement, might not be considered a failure. When measured against corporate plans and goals it might not be admitted to be a failure. But when measured against some aspects of the state-of-the-art it professed to advance, against fundamental ergonomic principles, and, especially, against its potential, it was a failure. Specifically, it failed to meet the expectations of one user. It is only fair, then, to begin by characterizing those expectations and giving some indication of their sources. Then follow five sections on various classes of failure. (The Precepts of the title are embedded in these sections.) The paper concludes with a brief discussion of the Two Morals. DOE

**N86-23335#** Logica Ltd., London (England).
**STATIC ANALYSIS PACKAGE EXTENSIONS Final Report**
R. H. Barlow, I. A. Inglis, and S. R. Patston Paris ESA 22 Apr. 1985 56 p
(Contract ESA-5685/83-NL-PP)
(Rept-74-4607; ESA-CR(P)-2093) Avail: NTIS HC A04/MF A01

The Static Analysis Package (SAP) a software quality assurance tool for FORTRAN programs which analyzes source code and creates a database of information to assist quality assessment, provide documentation, and determine test coverage was enhanced. The range of source code accepted was extended from pure ANSI FORTRAN X3.9 - 1978 to ANSI, VAX 11 and IBM VS versions of FORTRAN. Its reporting capabilities were also extended to meet the quality assurance demands of new language constructs. The operational use of SAP and clarity of its reporting were improved. Author (ESA)

**N86-23336#** ERA Ltd., Leatherhead (England).
**DEVELOPMENT OF SOFTWARE FOR COMPUTING THE COUPLING COEFFICIENTS OF THE ERS-1 ANTENNAS Final Report**
G. Y. Philippou, P. McAndrew, and B. Claydon Paris ESA Jan. 1985 189 p refs
(Contract ESTEC-5667/83-NL-PP)
(ERA-85-0011; ESA-CR(P)-2099) Avail: NTIS HC A09/MF A01

Software for computing the coupling between the antennas aboard the ERS-1 satellite was developed. The software is structured so that it can be readily modified to suit similar designs of satellite. The input data provides models for the antennas and the spacecraft. The output from the software can include the modified radiation patterns for the antennas as well as the coupling factors for the antennas in the form of coupling coefficients that relate the transmit antennas, the receive antennas, and the frequencies. The theory used to compute the coupling and the models for the antennas is discussed. The software was validated by comparison with measurements on a mock-up of the satellite. Guidelines for the use and validity of the results are given. Author (ESA)

**N86-23337#** Spur Electron Ltd., Havant (England).
**USER REQUIREMENT DOCUMENT FOR A EEE DATABASE**
Paris ESA Jan. 1985 61 p
(Contract ESTEC-6159/85-NL-AB(SC))
(SP-URD-001-25-01-84; ESA-CR(P)-2114) Avail: NTIS HC A04/MF A01

User requirements for the electromechanical, electrical, and electronic parts of a data base complying with ESA software standards are outlined. The guide is intended to be used as a stand alone document, and as an input to the Product Assurance Database. The list of files; file necessity; file content; interelationships, and security are covered. Author (ESA)

**N86-23338#** Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
**DISCUSSION PROPOSITION FOR COMPUTER AIDED DESIGN (CAD) DEVELOPMENTS IN ICES/STRUDL [DISCUSSIE VOORSTEL VOOR CAD ONTWIKKELINGEN IN ICES/STRUDL]**
A. W. M. Kok and C. F. Vrijman Jan. 1983 14 p refs Partly in DUTCH and ENGLISH
(ICES-STRUDL-83-2; B8575345) Avail: NTIS HC A02/MF A01

A civil engineering project to contribute to CAD developments is discussed. For the structural design program ICES/STRUDL, the STRUPLOT system with color displays verification was chosen. For the structural analysis test faciliity program verification, the ETHICS subsystem was obtained. Using an interface between the STRUDL data base and the ETHICS check programs, verification facilities can be easily introduced at user level. Author (ESA)

**N86-23339#** Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
**THE GEOMETRY OF AN ARBITRARY SHELL, DEFINED BY REFERENCE POINTS**
A. W. M. Kok 1983 12 p
(ICES-STRUDL-83-5; B8575348) Avail: NTIS HC A02/MF A01

The problem to determine the z-coordinate and the tangent axis XY-plane of an arbitrary point of a shell is studied. The shell surface between each of four grid points is approximated by Hermitian interpolation. Author (ESA)

**N86-23340#** National Bureau of Standards, Gaithersburg, Md. Center for Electronics and Electrical Engineering.
**MOS1: A PROGRAM FOR TWO-DIMENSIONAL ANALYSIS OF SI MOSFETs Final Report**
C. L. Wilson and J. L. Blue Apr. 1985 63 p
(PB86-102696; NBS/SP-400/77; LC-85-600520) Avail: NTIS HC A04/MF A02; also available SOD HC as 003-003-02657-3 CSCL 09C

The MOS1 program is a portable FORTRAN 77 program suitable for analysis of currents and fields in VLSI devices. The program solves three coupled nonlinear elliptic partial differential semiconductor device equations in two dimensions. Historically, these equations have been solved using a special-purpose program and batch runs on a large, fast computer. The authors use a general-purpose program which runs on a large minicomputer or scientific workstation. This report discusses the physical formulation of the semiconductor equations and the methods used to select the solution strategy. Author (GRA)

**N86-22541#** Selenia Industrie Associate S.p.A., Rome (Italy). Defence System Div.
**QUALITY OF THE TORNADO ATS SOFTWARE**
Fabio Frontalini *In its* Rivista Technica Selenia, Vol. 9, No. 3, 1985 1985 p 17-21 (For primary document see N86-22537 13-01)
Avail: NTIS HC A03/MF A01

**N86-22571#** Joint Publications Research Service, Arlington, Va.
**ON COMPUTER-AIDED PROGRAMMING OF PAL DEVICES**
Xin Tao and Shuliang Pu *In its* China Report: Science and Technology (JPRS-CST-86-007) 20 Feb. 1986 p 13-26 refs Transl. into ENGLISH from Zhejiang Daxue Xuebao (Zengkan) (Hangzhou, China), 25 Jul. 1985 p 124-132 (For primary document see N86-22570 13-05)
Avail: NTIS HC A04/MF A01

**N86-22747#** Joint Publications Research Service, Arlington, Va.
**SCREEN EDITING PROGRAM IN CHINESE**
Miaoping Mei *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 52-56 Transl. into ENGLISH from Xiaoxing Weixing Jisuanji Xitong (Shenyang, China), no. 2, 8 Feb. 1985 p 60-62 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

**N86-22752#** Joint Publications Research Service, Arlington, Va.
**OPTIMAL SELECTION OF PRODUCTION PLAN, SOFTWARE DESIGN**
Fu Fan *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 80-88 refs Transl. into ENGLISH from Zidonghua Xuebao (Beijing, China), v. 11, no. 1, Jan. 1985 p 87-93 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22753#** Joint Publications Research Service, Arlington, Va.
**COMPUTER-AIDED DESIGN OF OPTIMUM LINEAR CONTROL SYSTEMS**
Qinyou Wang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 89-96 refs Transl. into ENGLISH from Zidonghua Xuebao (Beijing, China), v. 11, no. 1, Jan. 1985 p 38-43 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22754#** Joint Publications Research Service, Arlington, Va.
**GEOMETRIC NONLINEAR ANALYSIS OF SHELLS**
Di Zhang and Zhongxiong Cai *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 97-111 refs Transl. into ENGLISH from Shuzhi Jisuan Yu Jisuanji Yingyong (Beijing, China), v. 6, no. 3, Sep. 1985 p 176-187 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22771#** Joint Publications Research Service, Arlington, Va.
**ACCURATE COMPUTER-AIDED DESIGN OF MMIC BROADBAND FET AMPLIFIERS**
Yongshi Wu and Herbert J. Carlin (Cornell Univ., Ithaca, N.Y.) *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 99-111 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 11, no. 4, Jul. 1983 p 76-84 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

**N86-23294#** Joint Publications Research Service, Arlington, Va.
**KARL-3 SYSTEM FOR AUTOMATED DESIGN OF PRINTED-BOARD CIRCUITS Abstract Only**
I. G. Vintinzenko, I. G. Malykh, and Yu. F. Mirnykh *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 1 Transl. into ENGLISH

from Avtomatizirovannyye Sistemi Upravleniya i Pribory Avtomatiki Vypusk 70 (Kharkov, USSR), 1984 p 93-99 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

**N86-23299#** Joint Publications Research Service, Arlington, Va.
**VECTOR COMPUTATION PROGRAM SYSTEM Abstract Only**
V. P. Razbegin, G. N. Kalyanov, and B. V. Kupriyanov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 6 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 4, Jul. - Aug. 1983 p 25-32 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

**N86-23300#** Joint Publications Research Service, Arlington, Va.
**SYSTEM OF AUTOMATED TESTING FOR MIXAL PROGRAMS Abstract Only**
V. L. Katkov and G. V. Yermakov *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 6-7 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 3, May - Jun. 1985 p 50-58 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

**N86-23303#** Joint Publications Research Service, Arlington, Va.
**GRAPH-TEXT CODING OF ALGORITHMS Abstract Only**
V. A. Zhizhko *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 9 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 3, May - Jun. 1985 p 14-24 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

**N86-23304#** Joint Publications Research Service, Arlington, Va.
**DEVELOPMENT OF DIALOGUE MODE MICROCOMPUTER PROGRAMMING USING YeS COMPUTERS Abstract Only**
A. A. Ilyukovich and V. Yu. Bobolovich *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 9-10 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (Kiev, USSR), no. 3, May - Jun. 1985 p 34-36 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

**N86-23306#** Joint Publications Research Service, Arlington, Va.
**RIS SYSTEM FOR COMPUTER-AIDED PREPARATION OF GRAPIC DOCUMENTATION Abstract Only**
V. L. Katkov, A. Ye. Khlebtsevich, and A. I. Bliznets *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 11 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (Kiev, USSR), no. 3, May - Jun. 1985 p 74-77 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

# 62 COMPUTER SYSTEMS

Includes computer networks.

**N86-23341** Notre Dame Univ., Ind.
**ANALYTICAL MODELS FOR PARALLEL PROCESSING SYSTEMS Ph.D. Thesis**
Hany Hussein Ammar 1985 165 p
Avail: Univ. Microfilms Order No. DA8524392

With the advances of Computer and Communication technology, the notions of parallel and distributed processing have gained increased importance. In this dissertation, analytical models of parallel processing systems in which a job subdivides into several concurrent tasks are considered. The dissertation is divided into two parts. In the first part, the definition and classification of parallel jobs are described, and current analytical models, which are based on Queuing Networks (QNs), are reviewed. Analytical models using the Generalized Stochastic Petri Nets (GSPNs) are considered, and an approximate hierarchical model, using both QNs and GSPNs, is presented. In the second part of the dissertation, the analysis of GSPNs is considered. The current methods of analysis are reviewed, and a more general method is presented. Also techniques for reducing the analysis complexity such as reduction and aggregation are developed. The applications of such techniques to the approximate hierarchical decomposition of Stochastic Petri Nets are described, and the approximate lumping of synhronous parallel operations is considered. Dissert. Abstr.

**N86-23342#** Illinois Univ., Urbana. Center for Supercomputing Research and Development.
**CENTER FOR SUPERCOMPUTING RESEARCH AND DEVELOPMENT (CEDAR) Progress Report, 25 Jan. 1985 - 24 Jan. 1986**
D. J. Kuck, E. S. Davidson, D. H. Lawrie, and A. H. Sameh 1986 17 p
(Contract DE-FG02-85ER-25001)
(DE86-002051; DOE/ER-25001/1) Avail: NTIS HC A02/MF A01

The Center for Supercomputing Research and Development (CSRD) is building the Cedar System, a prototype multiprocessor. Clusters of 8 tightly-coupled processors are being bought from Alliant Computer Systems, which based its system design on earlier University of Illinois work by the CSRD group. CSRD efforts span the hardware, software, and applications areas. The hardware group is designing and building a global network and shared global memory, as well as an Alliant interface. This will allow 8 clusters (of 8 processors) to operate together in 1986 and up to 64 clusters in 1987. Synchronization and data sharing are allowed by powerful hardware primitives. The software group is developing a Unix-based multiprocessor operating system and a Paraphrase (KAP)-based restructuring compiler. The compiler will transform serial as well as parallel FORTRAN constructs to exploit the system, dealing with vector as well as multiprocessing parallelism. CSRD is working for a rapid architectural increase in speed across a number of applications. DOE

**N86-22820#** Science Research Council, Edinburgh (Scotland). Rutherford Appleton Lab.
**THE USE OF SATELLITE CHANNELS FOR COMPUTER NETWORKING**
J. W. Burren *In* ESA Proceedings of International Symposium on Satellite Transmissions Nov. 1985 p 71-78 refs (For primary document see N86-22811 13-32)
Avail: NTIS HC A10/MF A01

**N86-23295#** Joint Publications Research Service, Arlington, Va.
**MODEL OF MULTIPROGRAM OPERATION IN NONHOMOGENEOUS COMPUTER SYSTEM WITH STRICT MEMORY DIVISION Abstract Only**
V. A. Vishnyakov and O. V. German *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 2 Transl. into ENGLISH from Avtomatika i Vychislitelnaya Tekhnika (Riga, USSR), no. 3, May - Jun. 1985 p 58-64 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

**N86-23301#** Joint Publications Research Service, Arlington, Va.
**TRACING AND ANALYSIS OF COMPUTER SYSTEMS BY MEANS OF THE STAN PROGRAM Abstract Only**
Ya. A. Kogan and L. B. Kozinskiy *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 7-8 Transl. into ENGLISH from Programmirovaniye (Moscow, USSR), no. 3, May - Jun. 1985 p 25-37 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

# 63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

**N86-23343*#** Scientific Systems, Inc., Cambridge, Mass.
**FAULT-TOLERANT CONTROL OF LARGE SPACE STRUCTURES USING THE STABLE FACTORIZATION APPROACH Final Report**
H. C. Razavi, R. K. Mehra, and M. Vidyasagar (Waterloo Univ., Ontario) Washington NASA Mar. 1986 38 p refs
(Contract NAS1-17946)
(NASA-CR-3964; NAS 1.26:3964; SSI-1103) Avail: NTIS HC A03/MF A01 CSCL 09B

Large space structures are characterized by the following features: they are in general infinite-dimensional systems, and have large numbers of undamped or lightly damped poles. Any attempt to apply linear control theory to large space structures must therefore take into account these features. Phase I consisted of an attempt to apply the recently developed Stable Factorization (SF) design philosophy to problems of large space structures, with particular attention to the aspects of robustness and fault tolerance. The final report on the Phase I effort consists of four sections, each devoted to one task. The first three sections report theoretical results, while the last consists of a design example. Significant results were obtained in all four tasks of the project. More specifically, an innovative approach to order reduction was obtained, stabilizing controller structures for plants with an infinite number of unstable poles were determined under some conditions, conditions for simultaneous stabilizability of an infinite number of plants were explored, and a fault tolerance controller design that stabilizes a flexible structure model was obtained which is robust against one failure condition. Author

**N86-23344#** Illinois Univ., Urbana. Decision and Control Lab.
**TWO STABILITY RESULTS FOR DISCRETE ONE STEP AHEAD ADAPTIVE CONTROL M.S. Thesis**
Douglas S. Rhode May 1985 58 p
(Contract N00014-84-C-0149)
(AD-A161306; DC-83; UILU-ENG-85-2220) Avail: NTIS HC A04/MF A01 CSCL 09/3

In this thesis, two stability results are developed for one step ahead adaptive controllers. In Chapter 2, an analysis is presented of the local behavior of a one step ahead adaptive controller around a tuned solution. Instead of placing assumptions on the order, delay or minimum phase properties of the plant, the existence of a unique tuned solution is assumed. This implies that for a particular reference model output there exists a unique stabilizing parameter vector such that the plant output will track the reference model output exactly. Assuming this tuned solution exists, the closed-loop system was shown to be locally stable, and small departures from the nominal do not disturb this stability. The second stability result presented in this thesis deals with the problems associated with direct adaptive control of a sampled data process. Even if a continuous time plant is minimum phase, sampling will often introduce nonminimum phase zeros in the equivalent discrete model. These nonminimum phase zeros cannot be cancelled if system stability is to be maintained. Johansson (1983) has shown that the minimum a priori knowledge needed is the unstable zero locations. Fortunately, Astrom et al. (1984) have established the location of these zeros for very rapidly sampled systems. Using this information, the algorithm presented in Section 3.2 retains the unstable zeros in the tracking transfer function. The analysis presented in Section 3.3 represents the first step towards establishing a robust direct adaptive scheme for sampled data systems. GRA

**N86-23345#** Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
**STUDY OF NONLINEARITIES IN OBSERVER CONTROL SYSTEMS WITH ANALOG COMPUTER SIMULATIONS**
Curtis Johansson Aug. 1985 33 p refs In SWEDISH; ENGLISH summary
(FOA-C-20581-E3; ISSN-0347-3694) Avail: NTIS HC A03/MF A01

Observer control technique is compared with traditional feedback methods. The investigation was limited to a simple system (integration + oscillation) with ordinary feedback, or observer feedback; limitation, dead zone, and backlash were introduced. The results of measurements on nonlinear systems must be interpreted and applied in a more restricted manner than in linear systems. For systems with static (frequency independent) nonlinearities, e.g., limitations and dead zones, the stability problems seem to be independent of the type of feedback. For systems with dynamic (frequency dependent) nonlinearities, such as backlash, the stability problem is considerably more difficult with observer feedback. Author (ESA)

**N86-23298#** Joint Publications Research Service, Arlington, Va.
**CONCEPT OF AUTOMATED MACRODESIGN OF NETWORKS OF AUTOMATED CONTROL SYSTEMS Abstract Only**
Yu. Yu. Kess *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 5 Transl. into ENGLISH from Upravlyayushchiye Sistemy i Mashiny (Kiev, USSR), no. 3, May - Jun. 1985 p 7-11 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

**N86-23310#** Joint Publications Research Service, Arlington, Va.
**FLEXIBLE PRODUCTION SYSTEMS AND THE DEVELOPMENT OF METHODS FOR THEIR CONTROL**
A. M. Voychinskiy *In its* USSR Report: Cybernetics, Computers and Automation Technology (JPRS-UCC-86-003) 20 Mar. 1986 p 27-35 refs Transl. into ENGLISH from Standarty i Kachestvo (Moscow, USSR), no. 8, Aug. 1985 p 18-21 (For primary document see N86-23293 13-60)
Avail: NTIS HC A04/MF A01

# 64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

**N86-23346#** Royal Signals and Radar Establishment, Malvern (England).
**LINE FINDING ALGORITHMS FOR SAR**
J. W. Wood Jul. 1985 23 p refs
(AD-A162024; RSRE-MEMO-3841; BR97301) HC A02/MF A01

The problem of locating linear features, not necessarily straight, in SAR images is addressed. The characteristics of such features and the way in which these characteristics affect the desired properties of line finding algorithms are discussed. Two line detection algorithms are described: the Hough transform, and the dynamic programming technique. Results of applying both algorithms to simulated and real SAR images are given. The Hough transform is found to be too restricted to be useful for this application. The dynamic programming technique locates lines well. The problem of spurious lines appearing in clutter is considered. Author (ESA)

**N86-23347** National Physical Lab., Teddington (England). Div. of Materials Applications.
**NUMERICAL DETERMINATION OF THE MOTION OF A CABLE-BODY SYSTEMS BY THE METHOD OF CHARACTERISTICS**
D. H. Ferriss Oct. 1985 30 p refs
(NPL-DMA(A)-109; ISSN-0143-7313) Copyright. Avail: Issuing Activity

Partial differential equations which describe the three-dimensional motion of a flexible, linearly elastic cable subjected to gravitational and hydrodynamic (or aerodynamic) loading are presented. One end of the cable is constrained to move in a given way and the other end is attached to a mass acted upon by drag and other forces representing the action of thrusters. The motion of the system from a given initial state is determined by

numerical solution of the six governing hyperbolic partial differential equations by the method of characteristics. Author (ESA)

**N86-23348** ENR Technisch Wetenschappelijk Rekencentrum, Petten (Netherlands).
**NUMBER OF UNIFIED MATHEMATICAL ROUTINE COLLECTIONS (NUMRCN): GENERAL SETUP, FACILITIES FOR INTERACTIVE RETRIEVAL AND THE GRAPHICS SUPPLEMENT [NUMRCN: ALGEMENE OPZET, FACILITEITEN VOOR INTERACTIEVE ONTSLUITING EN HET GRAFISCH SUPPLEMENT]**
G. P. Leendertse, A. C. B. denOuden, and C. J. Warmer Jun. 1984 47 p refs In DUTCH
(Rept-10) Copyright. Avail: Issuing Activity

A software library for numerical and statistical problems is described. Within the NUMRCN system, on-line documentation (a catalog with rough information and a description file with user documentation per routine) of the collections are present. For the interactive retrieval of the on-line documentation, a keyword combination based system was developed. Author (ESA)

**N86-23349#** National Aerospace Lab., Tokyo (Japan).
**FILTERING SAMPLER**
Akira Tada 1985 20 p refs In JAPANESE; ENGLISH summary
(NAL-TR-863) Avail: NTIS HC A02/MF A01

This paper describes the algorism and effect of the filtering sampler, which was recently developed as a part of a time series data acquisition system. The fundamental operation is a moving average with the weightings of binomial coefficients over discrete data. Each application of the above operation at every other input timing reduces the sampling rate by half and filters out high frequency noise components. Such fundamental operation is repeatedly applied to the data in cascade, so that the total operation reduces the sampling rate by a factor of any arbitrary number to the power of 2. The algorism reduced the load of the microprocessor for the filtering. The anti-aliasing effect is also found to be excellent in the low frequency region. Author

**N86-23350*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A COMBINED INTEGRATING AND DIFFERENTIATING MATRIX FORMULATION FOR BOUNDARY VALUE PROBLEMS ON RECTANGULAR DOMAINS Final Report**
W. D. Lakin (Old Dominion Univ.) Mar. 1986 31 p refs Submitted for publication
(Contracts NAS1-17070; NAS1-18107)
(NASA-CR-178074; ICASE-86-12; NAS 1.26:178074) Avail: NTIS HC A03/MF A01 CSCL 12A

Integrating and differentiating matrices allow the numerical integration and differential of functions whose values are known at points of a discrete grid. Previous derivations of these matrices were restricted to one dimensional grids or to rectangular grids with uniform spacing in at least one direction. Integrating and differentiating matrices were developed for grids with nonuniform spacing in both directions. The use of these matrices as operators to reformulate boundary value problems on rectangular domains as matrix problems for a finite dimensional solution vector is considered. The method requires nonuniform grids which include near boundary points. An eigenvalue problem for the transverse vibrations of a simply supported rectangular plate is solved to illustrate the method. Author

**N86-23351#** Florida State Univ., Tallahassee. Dept. of Statistics.
**ON THE LIMIT BEHAVIOR OF A MULTI-COMPARTMENT STORAGE MODEL WITH AN UNDERLYING MARKOV CHAIN. 1: WITHOUT NORMALIZATION**
Eric S. Tollar Feb. 1985 20 p
(Contract DAAG29-82-K-0168)
(AD-A161293; FSU-STATISTICS-M693; TR-D-76-ARO; ARO-19367.30-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

The present paper considers a multi-compartment storage model with one way flow. The inputs and outputs for each compartment are controlled by a denumerable state Markov chain. Assuming finite first moments, it is shown that certain compartments converge in distribution while others diverge, based on appropriate first moment conditions on the inputs and outputs. GRA

**N86-23352#** Sandia National Labs., Albuquerque, N. Mex.
**GLOBAL ERROR ESTIMATION WITH ONE-STEP METHODS**
L. F. Shampine Oct. 1985 23 p refs
(Contract DE-AC04-76DP-00789)
(DE86-002961; SAND-85-1377) Avail: NTIS HC A02/MF A01

The global, or true, error made by one-step methods when solving the initial value problem for a system of ordinary differential equations is studied. Some methods for approximating this global error are based on an asymptotic global error expansion. A new method based on such an expansion is presented. It exploits the fact that standard codes implement a pair of formulas in order to control the local error. A way of monitoring the computation so as to recognize when basic assumptions break down is proposed. Illustrative computations are provided. DOE

**N86-23353#** Los Alamos National Lab., N. Mex.
**RELATION BETWEEN FINITE ELEMENT METHODS AND NODAL METHODS IN TRANSPORT THEORY**
W. F. Walters 1985 19 p Presented at the International Seminar on Finite Element and Allied Methods for Reactor Physics and Shielding Calculations, London, England, 18 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000761; LA-UR-85-3276; CONF-850963-1) Avail: NTIS HC A02/MF A01

The relationship between nodal methods and finite-element methods for solving the discrete-ordinates form of the transport equation in x-y geometry is examined. Specifically, we the relation of three finite-element schemes to the linear-linear (LL) and linear-nodal (LN) nodal schemes is discussed. The three finite-element schemes are the linear-continuous-diamond-difference (DD) scheme, the linear-discontinuous (LD) scheme, and the quadratic-discontinuous (QD) scheme. A brief derivation of the (LL) and (LN) nodal schemes is given in the third section of this paper. The approximations that cause the LL scheme to reduce to the DD, LD, and QD schemes are then indicated. An extremely simple method of deriving the finite-element schemes is then introduced. DOE

**N86-23354#** Argonne National Lab., Ill.
**ALGORITHMS FOR SOLVING FINITE DIMENSIONAL SYSTEMS OF NONLINEAR EQUATIONS AND INEQUALITIES THAT HAVE BOTH GLOBAL AND QUADRATIC CONVERGENCE PROPERTIES**
J. Burke Aug. 1985 22 p
(Contract W-31-109-eng-38)
(DE86-001872; ANL/MCS-TM-54) Avail: NTIS HC A02/MF A01

Algorithms for solving finite dimensional systems of nonlinear equations and inequalities that have both global and quadratic convergence properties are presented. The techniques are based upon the Gauss-Newton type algorithms developed for the minimization of the distance function. Under the assumption of a constraint qualification, the algorithms are shown to be quadratically convergent. DOE

**N86-23355#** Sheffield Univ. (England). Dept. of Control Engineering.
**TENSOR OPERATORS AND LIMIT CYCLES IN NONLINEAR SYSTEMS**
S. P. Banks 1985 14 p refs
(RR-280-A) Avail: NTIS HC A02/MF A01

The theory of tensor operators is used to obtain criteria for the existence and nonexistence of limit cycles in nonlinear systems. A simple sufficient condition for the nonexistence of limit cycles in polynomial systems is given. By associating an infinite-dimensional tensor-valued system with the original nonlinear system and generalizing the Gersgorin circle theorem to tensors, linear spectral theory can be applied to show that the system oscillates if and only if the spectrum of the associated tensor operator

intersects the imaginary axis. The use of the method to predict the existence of limit cycles is much more difficult. It involves finding the spectrum of a tensor operator and showing the existence of an eigenvector of a specific form. Author (ESA)

**N86-23356#** Sheffield Univ. (England). Dept. of Control Engineering.
**A PREDICTION ERROR AND STEPWISE REGRESSION ESTIMATION ALGORITHM FOR NONLINEAR SYSTEMS**
S. A. Billings and W. S. F. Voon Sep. 1985 38 p refs
(Grant SERC-GR/B/31163)
(RR-281) Avail: NTIS HC A03/MF A01

The identification of nonlinear systems based on a nonlinear autoregressive moving average model with exogenous inputs model representation is considered and a combined stepwise regression/prediction error estimation algorithm is derived. The stepwise regression routine determines the model structure by detecting significant terms in the model, while the prediction error algorithm provides optimal estimates of the final model parameters. Implementation of the algorithms is discussed and simulated examples and industrial applications are included to illustrate that parsimonious models of nonlinear systems can be identified using the algorithm. Author (ESA)

**N86-23357#** Barcelona Univ. (Spain). Facultat d'Informatica de Barcelona.
**STUDY ON THE GENERATION OF TRAJECTORIES FOR MULTIPLE TARGET FLYBY MISSIONS**
E. Roth and J. Rodriguez Paris ESA Jul. 1985 242 p refs
(Contract ESOC-5646/83-D-JS(SC))
(FIB-RR-85/07; ESA-CR(P)-2139) Avail: NTIS HC A11/MF A01

The feasibility of asteroid exploratory missions was analyzed to set up models for the generation of ballistic traverses with restricted interflyby maneuvers. A preselection method based on neighborhood properties of close trajectories in an initial conditions space was developed. A very rich set of four and five body missions is shown to be feasible. With Ariane 4, missions of 6 asteroids are possible. Using mixed strategies, missions to nine bodies are feasible. Author (ESA)

**N86-23358#** Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
**TEST OF A SYSTEM FOR POSITIONING: SYLEDIS**
Sven Modig Oct. 1985 16 p In SWEDISH; ENGLISH summary
(FOA-C-20588-D8; ISSN-0347-3694) Avail: NTIS HC A02/MF A01

A system for positioning was tested in a field trial. It shows a great sensitivity to signal reflections, which reduce false steps on the plot and thus make the positioning very uncertain. Average length of difference vectors (between measured and true position) for vectors $<$ 500 m is 133 m, standard deviation 138 m. The system is not recommended. Author (ESA)

**N86-22749#** Joint Publications Research Service, Arlington, Va.
**SIMPLE METHOD TO CONSTRUCT CUBIC SPLINE FUNCTION DESCRIBED**
Fuqi Tan *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 52-58 refs Transl. into ENGLISH from Yingyong Shuxue He Lixue (Chongqing, China), v. 6, no. 6, Jun. 1985 p 567-472 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22750#** Joint Publications Research Service, Arlington, Va.
**MODEL FOR BOUNDARY INTEGRAL EQUATION IN SOLID MECHANICS**
Xingfeng Wang and Xingfa Wang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 59-70 refs Transl. into ENGLISH from Yingyong Shuxue He Lixue (Chongqing, China), v. 6, no. 6, Jun. 1985 p 531-540 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22809*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**VITERBI ALGORITHM ON A HYPERCUBE: CONCURRENT FORMULATION**
F. Pllara *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 249-255 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 12A

# 65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

**N86-23359** Stanford Univ., Calif.
**ALTERNATIVE VARIOGRAM ESTIMATORS IN GEOSTATICS Ph.D. Thesis**
Karl Henning Omre 1985 281 p
Avail: Univ. Microfilms Order No. DA8522206

The variogram function carries information about the spatial variability of the regionalized variable. Most geostatistical analyses are based on the structural information represented in this function. The statistical properties of the variogram value at a given lag h are discussed. Problems associated with the estimation of the variogram value, and a discussion of the properties of the traditional variogram estimator are presented. The case for which the traditional estimator is optimal is defined as the Ideal Case for variogram estimation. This case entails strong assumptions about the distributional characteristics of the regionalized variable and the sampling procedure performed. In practice, deviations from the Ideal Case occur. Three frequently occuring deviation models are defined: the distributional, the sampling and the outlier deviation models. Problems associated with prefrential sampling are thoroughly discussed. Author

**N86-23360#** Oak Ridge National Lab., Tenn.
**O-THEORY: A HYBRID UNCERTAINTY THEORY**
E. M. Oblow Oct. 1985 32 p
(Contract DE-AC05-84OR-21400)
(DE86-002610; ORNL/TM-9759) Avail: NTIS HC A03/MF A01

A hybrid uncertainty theory is developed to bridge the gap between fuzzy set theory and Bayesian inference theory. Its basis is the Dempster-Shafer formalism (a probability-like, set-theoretic approach), which is extended and expanded upon so as to include a complete set of basic operations for manipulating uncertainties in approximate reasoning. The new theory, operator-belief theory (OT), retains the probabilistic flavor of Bayesian inference but includes the potential for defining a wider range of operators like those found in fuzzy set theory. The basic operations defined for OT in this paper include those for: dominance and order, union, intersection, complement and general mappings. A formal relationship between the membership function in fuzzy set theory and the upper probability function in the Dempster-Shafer formalism is also developed. Several sample problems in logical inference are worked out to illustrate the results derived from this new approach as well as to compare them with the other theories currently being used. A general method of extending the theory using the historical development of fuzzy set theory as an example is suggested. DOE

**N86-23361#** Sandia National Labs., Albuquerque, N. Mex.
**MEASURE OF TOP-DOWN CORRELATION**
R. L. Iman and W. J. Conover Oct. 1985 52 p Prepared in cooperation with Texas Tech Univ., Lubbock, Tex.
(Contract DE-AC04-76DP-00789)
(DE86-002530; SAND-85-0601) Avail: NTIS HC A04/MF A01

Many situations exist in which n objects are ranked by two independent sources. For example, n brands of a given type of food product are ranked by taste test by two different individuals; n input variables to a computer model are ranked with respect to their influence on the model output variables by two different

criteria; and company objectives are ranked by management and again by employees. In each of these settings, interest centers primarily on agreement in the top rankings, with disagreements on items at the bottom of the rankings being of little or no importance. That is, can consumers agree on the most preferred brands of a certain type of food product; do different techniques of measuring the sensitivity of an output variable to various input variables in a computer model agree on the selection of the most important variables; and is there agreement between management and employees on the most urgent objectives. A problem with Spearman's rho in the present setting is that it is equally influenced by disagreement on the assignment of rankings at all levels. In this paper, a measure of correlation is provided that is more sensitive to agreement on the top rankings. The statistic used in this setting is the ordinary correlation coefficient computed on Savage (1956) scores. The asymptotic normality of this statistic is shown, tables of the exact distribution are provided for n = 3(1)14, and models are presented for which this is the locally most powerful rank test. DOE

**N86-23362#** Oak Ridge National Lab., Tenn.
**INDUCTIVE TIME SERIES MODELING PROGRAM**
B. L. Kirk and B. W. Rust Oct. 1985 112 p refs
(Contract DE-AC05-84OR-21400)
(DE86-002553; ORNL/TM-7534) Avail: NTIS HC A06/MF A01

A number of features that comprise environmental time series share a common mathematical behavior. Analysis of the Mauna Loa carbon dioxide record and other time series is aimed at constructing mathematical functions which describe as many major features of the data as possible. A trend function is fit to the data, removed, and the resulting residuals analyzed for any significant behavior. This is repeated until the residuals are driven to white noise. In the following discussion, the concept of trend will include cyclic components. The mathematical tools and program packages used are VARPRO (Golub and Pereyra 1973), for the least squares fit, and a modified version of our spectral analysis program (Kirk et al. 1979), for spectrum and noise analysis. The program is written in FORTRAN. All computations are done in double precision, except for the plotting calls where the DISSPLA package is used. The core requirement varies between 600 K and 700 K. The program is implemented on the IBM 360/370. Currently, the program can analyze up to five different time series where each series contains no more than 300 points. DOE

**N86-23363#** Los Alamos National Lab., N. Mex.
**PREDICTION APPROACH TO MULTISTAGE SAMPLING WHEN CLUSTER SIZES ARE UNKNOWN**
E. J. Kelly and W. G. Cumberland 1985 10 p refs Presented at the American Statistical Association for Joint Statistical Meetings, Las Vegas, Nev., 5 Aug. 1985 Prepared in cooperation with California Univ., Los Angeles
(Contract W-7405-eng-36)
(DE86-000769; LA-UR-85-3237; CONF-8508115-6) Avail: NTIS HC A02/MF A01

A model for two-stage cluster sampling when sample cluster sizes are unknown is used to derive an optimal (model-based) estimator for the population total and to determine robust sampling strategies. In an empirical study using 1970 and 1980 census data for Los Angeles and surrounding counties, comparisons are made between the model based estimator and conventional estimators. The results favor the new estimator over those derived from randomization theory. In addition, the empirical study shows that the robust sampling strategies suggested by the theory can reduce biases, improve efficiency, and decrease the frequencies of large errors. DOE

# 66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

**N86-23364#** Harvard Univ., Cambridge, Mass. Computation Lab.
**EXTENSION OF THE PARALLEL NESTED DISSECTION ALGORITHM TO THE PATH ALGEBRA PROBLEMS**
Victor Pan and John H. Reif 1985 11 p
(Contract N00014-80-C-0647)
(AD-A161304; TR-15-85) Avail: NTIS HC A02/MF A01 CSCL 12/1

The authors' recent parallel nested dissection algorithm for solving linear systems is extended in order to substantially accelerate several path algebra computations in both cases of a single source path and of all pair paths where the path problem is defined by a sparse matrix whose associated graph has a family of small separators. Author (GRA)

**N86-23365#** Sheffield Univ. (England). Dept. of Control Engineering.
**EXPERIMENTAL DESIGN AND IDENTIFIABILITY FOR NONLINEAR SYSTEMS**
I. J. Leontaritis and S. A. Billings Sep. 1985 27 p refs
(RR-280-B) Avail: NTIS HC A03/MF A01

Experiment design for the identification of nonlinear systems based on the criterion that the accuracy of the parameter estimates should be maximized is discussed. In open-loop operation the optimum input sequence for a completely unknown nonlinear system is derived using results from information theory. The optimum input is an independent sequence with a Gaussian distribution for a power constraint on the input and an independent sequence with a uniform distribution for an amplitude constraint on the input. The results differ from the optimum input sequences for linear systems and it is shown that identifiability problems can arise if optimum sequences for linear systems are used as inputs for nonlinear systems. Practical guidelines for the design of experiments in closed-loop operation are given. Author (ESA)

# 67 THEORETICAL MATHEMATICS

Includes topology and number theory.

**N86-23366#** Center for Mathematics and Computer Science, Amsterdam (Netherlands).
**IN 1983 FALTINGS PROVED BY CONJECTURE BY MORDELL, SHAFAREVICH AND TATE**
Frans Oort (Utrecht State Univ., Netherlands), Arjeh M. Cohen, Richard D. Gill, ed., and Jan Heering, ed. Dec. 1984 55 p refs (CWI-Newsletter5,84; ISSN-0168-826x) Avail: NTIS HC A04/MF A01

The significance of the Mordell-Faltings theorem which confirms the Mordell's conjecture is discussed. The method of the proof is not effective. Author (ESA)

# 70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

**N86-23367#** Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
**DYNAMICS OF GYROELASTIC VEHICLES**
Gabriele M. T. DEleuterio Jan. 1986 191 p refs
(UTIAS-300; ISSN-0082-5255) Avail: NTIS HC A09/MF A01

The dynamics of gyroelastic vehicles are analyzed. A gyroelastic vehicle consists of a number of flexible appendages, with distributions of gyricity, attached to a central rigid body, which may also have stored angular momentum. Constrained and unconstrained dynamics are discussed. The equation of motion is derived and cast into a general first order operator form. An extensive modal analysis is performed from which a set of orthogonality conditions for the mode shapes is obtained. The

theoretical results are demonstrated using a finite element procedure on a uniform cantilevered rod. The analytical results are verified by a series of numerical examples which also serve to illustrate different aspects of the theory: a uniform constrained rod, a rod with a rigid body, a rod with an internal joint, and a triorthogoral-boom spacecraft modal metamorphosis and the dependence of the vibrational frequencies on gyricity are closely studied. B.G.

# 71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

**N86-23368** California Univ., Berkeley.
**NOISE EFFECTS NEAR THE ONSET OF SIMPLE DYNAMICAL INSTABILITIES Ph.D. Thesis**
Kurt Arn Wiesenfeld 1985 275 p
Avail: Univ. Microfilms Order No. DA8525155

The effect of random noise is expected to be most important for systems that are near an instability. Dynamical systems that display bifurcations of either time independent or time periodic solutions, with particular emphasis placed on codimension-one and codimension-two bifurcations are examined. Noise is introduced phenomenologically, and both state independent (additive) and state dependent (multiplicative) noises are considered. A general finding is that, for parameter values close to those for the onset of the instability, a great simplification in the description of the stochastic problem is possible. The methods employed parallel closely those familiar from bifurcation theory of deterministic dynamical systems. In a sense, the results of bifurcation theory are extended to include the effects of external noise. For bifurcations of time independent solutions, a procedure motivated by the Center Manifold Theorem is developed that drastically reduces the number of independent variables involved in the Fokker-Planck equation for the probability density. The van der Pol-Duffing oscillator is studied in detail. The scaling predictions were tested, and verified, experimentally for periodically driven p-n junctions. Dissert. Abstr.

**N86-23369#** Defence Research Information Centre, Orpington (England).
**RADIATION PATTERN OF ACOUSTIC EMISSION**
M. Otsu Sep. 1985 21 p refs Transl. into ENGLISH from Zairyo, vol. 32, no. 356, 1983 p 577-583
(DRIC-T-7599; BR97248) HC A02/MF A01

The suitability of consideration of acoustic emission (AE) wave motions as elastic wave motions generated from a dislocation mode is demonstrated on the basis of one AE waveform characteristic, the radiation pattern. Through application of a fracture source detection method, determination of dislocation model kinematic factors is established. This fracture source detection method can provide information in surveillance of microfractures in concrete structures. Author (ESA)

**N86-23370*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**NONLINEAR ACOUSTIC WAVE PROPAGATION IN ATMOSPHERE Final Report**
S. I. Hariharan (Akron Univ., Ohio) Mar. 1986 29 p refs Submitted for publication
(Contracts NAS1-17070; NAS1-18107; Grant NAG1-527)
(NASA-CR-178069; ICASE-86-01; NAS 1.26:178069) Avail: NTIS HC A02/MF A01 CSCL 20A

In this paper a model problem is considered that simulates an atmospheric acoustic wave propagation situation that is nonlinear. The model is derived from the basic Euler equations for the atmospheric flow and from the regular perturbations for the acoustic part. The nonlinear effects are studied by obtaining two successive linear problems in which the second one involves the solution of the first problem. Well-posedness of these problems is discussed and approximations of the radiation boundary conditions that can be used in numerical simulations are presented. Author

**N86-23371*#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
**FREE JET FEASIBILITY STUDY OF A THERMAL ACOUSTIC SHIELD CONCEPT FOR AST/VCE APPLICATION-DUAL FLOW. COMPREHENSIVE DATA REPORT. VOLUME 1: TEST NOZZLES AND ACOUSTIC DATA**
B. A. Janardan, J. F. Brausch, and A. O. Price Oct. 1984 501 p refs 2 Vol.
(Contract NAS3-22137)
(NASA-CR-174817; NAS 1.26:174817; R84AEB570) Avail: NTIS HC A22/MF A01 CSCL 20A

Acoustic and diagnostic data that were obtained to determine the influence of selected geometric and aerodynamic flow variables of coannular nozzles with thermal acoustic shields are summarized in this comprehensive data report. A total of 136 static and simulated flight acoustic test points were conducted with 9 scale-model nozzles The tested nozzles included baseline (unshielded), 180 deg shielded, and 360 deg shielded dual flow coannular plug configurations. The baseline configurations include a high radius ratio unsuppressed coannular plug nozzle and a coanuular plug nozzle and a coannular plug nozzle with a 20-chute outer stream suppressor. The tests were conducted at nozzle temperatures and pressure typical of operating conditions of variable cycle engine. Author

**N86-23372*#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
**FREE-JET FEASIBILITY STUDY OF A THERMAL ACOUSTIC SHIELD CONCEPT FOR AST/VCE APPLICATION-DUAL STREAM NOZZLES. COMPREHENSIVE DATA REPORT. VOLUME 2: LASER VELOCIMETER AND SUPPRESSOR. BASE PRESSURE DATA**
B. A. Janardan, J. F. Brausch, and A. O. Price Oct. 1984 234 p 2 Vol.
(Contract NAS3-22137)
(NASA-CR-174818; NAS 1.26:174818; R84AEB570) Avail: NTIS HC A11/MF A01 CSCL 20A

Acoustic and diagnostic data that were obtained to determine the influence of selected geometric and aerodynamic flow variables of coannular nozzles with thermal acoustic shields are summarized in this comprehensive data report. A total of 136 static and simulated flight acoustic test points were conducted with 9 scale-model nozzles. Aerodynamic laser velocimeter measurements were made for four selected plumes. In addition, static pressure data in the chute base region of the suppressor configurations were obtained to assess the influence of the shield stream on the suppressor base drag. Author

**N86-23373#** California Univ., Berkeley. Lawrence Berkeley Lab.
**NEW THEORETICAL ASPECTS OF RESONANT PHOTOACOUSTIC SPECTROSCOPY**
R. Gerlach, R. H. Johnson, and N. M. Amer Jun. 1985 6 p refs Presented at the 4th International Topical Meeting on Photoacoustic, Thermal and Related Sciences, Quebec, Canada, 4 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002884; LBL-20187; CONF-850886-4) Avail: NTIS HC A02/MF A01

We derive the surface Q for an arbitrary mode, compare azimuthal to radial mode signal, discuss cell size considerations, and compare to nonresonant PAS. DOE

**N86-23374#** Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
**ULTRASONIC PULSER AND RECEIVER/PREAMPLIFIER SYSTEM WITH EXTENDED DYNAMIC RANGE AND LOW BASELINE DISTORTION**
L. S. Beller and L. C. Johnson Aug. 1985 9 p
(Contract DE-AC07-76ID-01570)
(DE86-002306; EGG-MS-6958) Avail: NTIS HC A02/MF A01

Conventional design practice in commercial and laboratory ultrasonic instrumentation results in performance which is less than ideal for many advanced applications in research and in automated systems. The major problems with most such instrumentation can be traced to inadequate dynamic range and to baseline distortion arising from AC coupling between stages. This is a preliminary report on an ultrasonic pulser and receiver/preamplifier system having greatly expanded sensitivity and lower noise characteristics in many ultrasonic applications. In at least one application of the new instruments, an improvement of 30 to 40 dB in dynamic range can be achieved. DOE

**N86-22758#** Joint Publications Research Service, Arlington, Va.
**APPLICATION OF ADAPTIVE SEGMENTATION TO SIGNAL ANALYSIS IN UNDERWATER ACOUSTICS Abstract Only**
Guoqing Wu *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 133 Transl. into ENGLISH from Yingyong Shengxue (Beijing, China), v. 4, no. 4, Oct. 1985 p 23-32 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22759#** Joint Publications Research Service, Arlington, Va.
**APPLICATION OF CLASS-D POWER AMPLIFIER IN UNDERWATER SOUND PROJECTOR Abstract Only**
Enping Sun *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 134 Transl. into ENGLISH from Yingyong Shengxue (Beijing, China), v. 4, no. 4, Oct. 1985 p 42; 43-44 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

**N86-22963*#** Johns Hopkins Univ., Baltimore, Md.
**ULTRASONIC NONDESTRUCTIVE MATERIALS CHARACTERIZATION**
Robert E. Green, Jr. *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 1-29 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22964*#** Rockwell International Science Center, Thousand Oaks, Calif.
**ULTRASONIC CHARACTERIZATION OF MICROSTRUCTURE IN POWDER METAL ALLOY**
B. R. Tittmann, L. A. Ahlberg, and K. Fertig *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 31-47 refs (For primary document see N86-22962 13-38)
(Contract W-7405-eng-82)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22965*#** Cornell Univ., Ithaca, N.Y.
**STUDIES OF ACOUSTIC EMISSION FROM POINT AND EXTENDED SOURCES**
Wolfgang Sachse, Kwang Yul Kim, and C. P. Chen *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 49-59 refs Sponsored in part by NSF and Navy (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22966*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**RESIDUAL STRESS MEASUREMENTS IN CARBON STEEL**
Joseph S. Heyman and Namkung Min (William and Mary Coll., Williamsburg, Va.) *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 61-74 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22967*#** Ohio State Univ., Columbus.
**ULTRASONIC MEASUREMENT OF POROSITY IN CASTS AND WELDS**
Laszlo Adler and Shaio-Wen Wang *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 75-81 refs (For primary document see N86-22962 13-38)
(Contract W-7405-eng-82)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22968*#** Johns Hopkins Univ., Baltimore, Md.
**ANALYTICAL ULTRASONICS FOR CHARACTERIZATION OF METALLURGICAL MICROSTRUCTURES AND TRANSFORMATIONS**
Moshe Rosen *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 83-102 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22969*#** Argonne National Lab., Ill.
**ANALYTICAL ULTRASONICS FOR STRUCTURAL MATERIALS**
David S. Kupperman *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 103-115 refs Previously announced in IAA as N85-34600 Sponsored in part by NRC and DOE (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22970*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ULTRASONIC CHARACTERIZATION OF STRUCTURAL CERAMICS**
Stanley J. Klima and George Y. Baaklini *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 117-126 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22971*#** Iowa State Univ. of Science and Technology, Ames.
**ON THE INTERACTION OF ULTRASOUND WITH CRACKS: APPLICATIONS TO FATIGUE CRACK GROWTH**
O. Buck, R. B. Thompson, and D. K. Rehbein *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 127-140 refs (For primary document see N86-22962 13-38)
(Contract W-7405-eng-82)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22972*#** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**ANALYTICAL ULTRASONICS FOR EVALUATION OF COMPOSITE MATERIALS RESPONSE. PART 1: PHYSICAL INTERPRETATION**
Edmund G. Henneke, II and John C. Duke, Jr. *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 141-152 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22973*#** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**ANALYTICAL ULTRASONICS FOR EVALUATION OF COMPOSITE MATERIALS RESPONSE. PART 2: GENERATION AND DETECTION**
John C. Duke, Jr. and Edmund G. Henneke, II *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 153-168 refs (For primary document see N86-22962 13-38)
(Grants NsG3-172; NAG3-323)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22974*#** Iowa State Univ. of Science and Technology, Ames.
**INFERENCE OF STRESS AND TEXTURE FROM ANGULAR DEPENDENCE OF ULTRASONIC PLATE MODE VELOCITIES**
R. B. Thompson, J. F. Smith, and S. S. Lee *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 169-180 refs (For primary document see N86-22962 13-38)
(Contract W-7405-eng-82)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22975*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EFFECT OF STRESS ON ULTRASONIC PULSES IN FIBER REINFORCED COMPOSITES**
John H. Hemann (Cleveland State Univ., Ohio) and George Y. Baaklini *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 181-191 refs Previously announced in IAA as N83-33180 (For primary document see N86-22962 13-38)
(Grant NAG3-106)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22976*#** Massachusetts Inst. of Tech., Cambridge.
**PATTERN RECOGNITION CHARACTERIZATIONS OF MICROMECHANICAL AND MORPHOLOGICAL MATERIALS STATES VIA ANALYTICAL QUANTITATIVE ULTRASONICS**
James H. Williams, Jr. and Samson S. Lee *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 193-205 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01

**N86-22977*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ULTRASONIC VERIFICATION OF MICROSTRUCTURAL CHANGES DUE TO HEAT TREATMENT**
Edward R. Generazio *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 207-217 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22978*#** Lowell Univ., Mass.
**ULTRASONIC MATERIAL PROPERTY DETERMINATIONS**
Steven Serabian *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 219-232 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22979*#** Ohio State Univ., Columbus.
**DYNAMIC MODULI AND LOCALIZED DAMAGE IN COMPOSITES**
L. S. Fu *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 233-256 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22980*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**TRANSFER FUNCTION CONCEPT FOR ULTRASONIC CHARACTERIZATION OF MATERIAL MICROSTRUCTURES**
Alex Vary and Harold E. Kautz *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 251-297 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22981*#** Ohio State Univ., Columbus. Dept. of Welding Engineering.
**ADHESIVE JOINT EVALUATION BY ULTRASONIC INTERFACE AND LAMB WAVES**
S. I. Rokhlin *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 299-310 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22982*#** Massachusetts Inst. of Tech., Cambridge.
**INPUT-OUTPUT CHARACTERIZATION OF AN ULTRASONIC TESTING SYSTEM BY DIGITAL SIGNAL ANALYSIS**
James H. Williams, Jr., Samson S. Lee, and Hira Karagulle *In* NASA. Lewis Research Center Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 311-339 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

**N86-22983*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**QUANTITATIVE FLAW CHARACTERIZATION WITH SCANNING LASER ACOUSTIC MICROSCOPY**
Edward R. Generazio and Don J. Roth *In its* Analytical Ultrasonics in Materials Research and Testing Jan. 1986 p 341-358 refs (For primary document see N86-22962 13-38)
Avail: NTIS HC A16/MF A01 CSCL 20A

# 72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

**N86-23375** Pennsylvania Univ., Philadelphia.
**RAMAN SCATTERING EXCITATION PROFILES AS A PROBE OF THE VALENCE ELECTRON EXCITATIONS OF MOLECULES ADSORBED ON METAL SURFACES Ph.D. Thesis**
Andrew David Brotman 1985 179 p
HC A05/MF A01

Measurements of Raman scattering excitation profile spectra for totally symmetric and nontotally symmetric vibration modes of free base phthalocyanine molecules adsorbed on silver were used as a modulation spectroscopic probe to obtain information about the energies, widths and vibronic character of the singlet valence electron excitations and about the character of the bonding of the adsorbate by the substrate. The data show that the Q sub x and Q sub y excitations of isolated free-base phthalocyanine molecules, and broadened, and that the Q sub x and Q sub y energy separation is reduced by about a factor of two. The data indicate that the resonant Raman scattering at the Q sub x and Q sub y excitations is due primarily to a Herzberg-Teller mechanism that involves vibronic coupling of the nearly degenerate Q sub x and Q sub y states with one another and with higher singlet states. The results suggest that the pi electrons are not primarily involved in the bonding of the phthalocyanine to the silver substrate. Dissert. Abstr.

**N86-23376#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
**THE VARIATIONAL ALTERNANT MOLECULAR ORBITAL METHOD FOR 3-D AND 2-D HYDROGEN MOLECULE**
E. A. deAndradaeSilva, I. C. daCunhaLima, and A. FerreiradaSilva Dec. 1985 23 p refs Submitted for publication
(INPE-3746-PRE/872) Avail: NTIS HC A02/MF A01

The variational alternant Molecular Orbital Method (VAMO) dimensional hydrogen molecules. The energies of the electron system are obtained, together with the equilibrium distances of the molecules. The integrals equivalent to the Slater's integrals of the nonvariational method are described. Applications of this method to realizable systems are also described. Author

**N86-23377#** California Univ., Berkeley. Dept. of Chemistry.
**MOLECULAR SPECTROSCOPY BY STEPWISE TWO-PHOTON ION-PAIR PRODUCTION AT 71 nm**
A. H. Kung, R. H. Page, R. J. Larkin, Y. R. Shen, and Y. T. Lee Jun. 1985 5 p Presented at the 7th International Conference on Laser Spectroscopy, Maui, Hawaii, 24 Jun. 1985 Prepared in cooperation with Lawrence Berkeley Lab., Calif.
(Contract DE-AC03-76SF-00098)
(DE86-001980; LBL-20069; CONF-850605-6) Avail: NTIS HC A02/MF A01

The Rydberg states of H2 have been a continuing subject of intensive study by various research groups. However, understanding of the high lying electronic states of this molecule has been inhibited by the lack of spectroscopic data in the region < nm. Experimental studies have been difficult because spectroscopic features are generally buried under an intense absorption or photoionization continuum. Intense, high-resolution excitation sources are not easily available. Recent developments on tunable, narrowband, coherent xuv sources provide new means of studying the spectroscopy in this region with high resolution (+ or - .0005 nm). The technique of stepwise two-photon excitation is used to study photoionization of H2 in a molecular beam using the two lowest excited states of

H2 as the intermediate level. This excitation, coupled with the detection of background-free H(-) ions has enabled us to uncover, for the first time, spectroscopic features that are difficult to observe in positive ion detection. These features have been successfully assigned to new Rydberg series converging to the high vibrations of the H2(+) ground electronic state. DOE

**N86-23378#** Aerodyne Research, Inc., Billerica, Mass. Center for Chemical and Environmental Physics.
**STUDY OF A NEW SOURCE FOR POSITIVE AND NEGATIVE IONS Final Report**
A. Freedman and P. Davidovits May 1985 42 p
(Contract DE-AC02-84ER-80135)
(DE86-002044; DOE/ER-80135/1; ARI-RR-473) Avail: NTIS HC A03/MF A01

The feasibility of a novel ion source based on the technique of photodissociation, which could provide both positive and negative ions at considerably higher intensities (potentially 10(15) cm(-3)) than are currently available is discussed. Ions are produced by irradiating a sample of a gaseous thallium halide salt with an argon fluoride excimer laser operating at 193 nm. At this wavelength, both thallium bromide and iodide will produce atomic ion pairs in a single photon process and molecular positive ions and an electron in a two-photon induced process. The potential traits of such an excimer-laser pumped thallium salt ion source include the following: high intensity and pulse rate, good spatial and temporal resolution, low temperature, good focusing properties, and production of heavy ions. A Phase I effort investigating the efficacy of this approach is reported. The last section will summarize the basic conclusions derived from these studies, as well as discuss potential advantages of an ion source derived from photolyzing thallium halide salts. DOE

**N86-23379#** Nebraska Univ., Lincoln. Dept. of Physics and Astronomy.
**HYPERSPHERICAL COORDINATE THEORY OF TWO ELECTRON ATOMIC PROCESSES Performance Report, 1 Aug. 1984 - 31 Jul. 1985**
J. Macek and A. F. Starace Sep. 1985 19 p refs
(Contract DE-AC02-82ER-12081)
(DE86-002462; DOE/ER-12081/11) Avail: NTIS HC A02/MF A01

State-of-the-art calculations employing hyperspherical coordinates are discussed. Work on the following seven specific problems has been completed: (1) Representation of two-electron wave functions for (1)S states in terms of a Fock expansion has been accomplished and a procedure for matching these series solutions onto an adiabatic hyperspherical representation has been developed. 2) In regions of configuration space where one electron is much further from the nucleus than the other, the R-matrix has been shown to be asymmetric. (3) Also in this region, the transformation of the coupled adiabatic hyperspherical channels to independent particle coordinates has been derived. (4) A study of the Wannier threshold law in Jacobi coordinates has been completed. (5) The electron doubly differential cross section for 0.5 MeV H(-)-H detachment collisions has been calculated. (6) The hyperspherical coordinate description of doubly excited states has been compared with other correlated models. (7) The length, velocity, and acceleration formulas for the electric dipole matrix element in hyperspherical coordinates have been derived. DOE

**N86-23380#** JAYCOR, San Diego, Calif.
**LIMITATIONS IN THE STRESS PARAMETER APPROACH TO EVALUATING SIMULATION FIDELITY**
W. Seidler, B. Passenheim, B. Kitterer, and W. Beezhold 1985 25 p Presented at the 6th JOWOG Meeting, Aldermaston, England, 7 Oct. 1985 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-001910; SAND-85-2177C; CONF-8510165-6) Avail: NTIS HC A02/MF A01

The stress parameter methodology of evaluating the fidelity of bremmsstrahlung X-ray simulators is examined by comparing the responses generated in simplified circuit boards exposed to the 155-keV Modular Bremsstrahlung Source (MBS) and 1.5-MeV Blackjack 5 (BJ5) environments. Comparisons between analytical estimates of the canonical stresses used to estimate fidelity and measurements indicate that the set of stress parameters was inadequate to predict whether box IEMP coupling would be overstressed or understressed for equal dose (silicon) in either simulator. An improved set of stress parameters is presented along with the accuracy requirements for our knowledge of electron yields. DOE

**N86-23381#** Sandia National Labs., Albuquerque, N. Mex.
**RECENT ADVANCES IN SHORT PULSE X-RAY SIMULATORS**
M. A. Hedemann, J. R. Lee, G. T. Baldwin, C. R. McClenahan, and P. W. Spence 1985 20 p Presented at the 6th JOWOG Meeting, Aldermaston, England, 7 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001911; SAND-85-2221C; CONF-8510165-5) Avail: NTIS HC A02/MF A01

Several bremsstrahlung X-ray simulators, with peak voltages from 1 to 2 MV, have recently become operational at Sandia Laboratories with pulse widths in the range of 10 to 40 nsec. Most of these simulator sources utilize the triaxial diode concept in order to efficiently couple generator energy into an electron beam. A description of the various simulator sources is given. DOE

**N86-23382#** Tennessee Univ., Knoxville.
**ATOM CAPTURE AND LOSS IN ION MOLECULE COLLISIONS**
M. Breinig, S. E. Lasley, and C. C. Gaither, III 1985 8 p refs Presented at the 14th International Conference on the Physics of Electronic and Atomic Collisions, Palo Alto, Calif., 24 Jul. 1985 Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract DE-AC05-84OR-21400)
(DE86-002197; CONF-850701-5) Avail: NTIS HC A02/MF A01

Progress is reported in measuring the energy and angular distribution of protons emerging with velocity close to the beam velocity from the target region when Ar(+) beams collide with a CH4 target and ArH(+) beams collide with a He target at asymptotically high speeds. The protons result from the transfer of a target constituent to the projectile (atom capture) or from the dissociation of the projectile molecule in the collision (atom loss). For atom capture processes the Thomas peak is clearly observed. DOE

**N86-23383#** Oak Ridge National Lab., Tenn.
**SPUTTER ATOMIZATION/RESONANCE IONIZATION MASS SPECTROMETRY FOR HIGH SENSITIVITY ISOTOPIC ANALYSIS**
D. L. Donohue, W. H. Christie, D. E. Goeringer, D. H. Smith, and H. S. McKown 1985 7 p refs Presented at the 28th Conference on Analytical Chemistry, Knoxville, Tenn., 30 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002198; CONF-850937-2) Avail: NTIS HC A02/MF A01

Resonance Ionization Mass Spectrometry (RIMS) combines the selectivity and sensitivity of resonance ionization spectroscopy (RIS) with high performance mass spectrometry. Results from our laboratory and elsewhere have been reported for a variety of elements using thermal vaporization sources to produce the atom reservoir for laser-induced resonance ionization. In this paper we describe the use of ion beam sputtering as an ultrasensitive method of atom formation for RIMS. A commercial ion microprobe mass analyzer (IMMA) has been interfaced with a tunable pulsed dye laser for carrying out resonance ionization mass spectrometry of sputtered atoms. This paper will describe the changes necessary to adapt the IMMA instrument for resonance ionization, along with preliminary results for the elements Sm and U. DOE

**N86-23384#** Oak Ridge National Lab., Tenn.
**SANS STUDIES OF MICELLAR AND MAGNETIC FLUIDS**
J. B. Hayter Aug. 1985 31 p refs Presented at the Complex and Supermolecular Fluids International Symposium, Annandale, N.J., 17 Jun. 1985

(Contract DE-AC05-84OR-21400)
(DE86-002207; CONF-8506211-1) Avail: NTIS HC A03/MF A01

Small-angle neutron scattering (SANS) has proved to be an excellent technique for the study of complex fluids. This article introduces SANS from the viewpoint of such studies. The use of SANS to determine the structures of concentrated micellar fluids is then discussed within the framework of current one-component macrofluid (OCM) models, and experimental examples are taken from several contemporary studies. Finally, the discussion is extended to magnetic fluids (ferrofluids) in which the neutron magnetic interaction plays an important experimental role. DOE

**N86-23385#** Institute for Advanced Study, Princeton, N.J.
**BASIC RESEARCH IN THEORETICAL HIGH ENERGY PHYSICS Progress Report, 30 Apr. 1984 - 30 Apr. 1985**
S. L. Adler 1985 17 p refs
(Contract DE-AC02-76ER-02220)
(DE86-001840; DOE/ER-02220/14) Avail: NTIS HC A02/MF A01

Progress is reported on non-perturbative problems in quantum field theories, including a field-theoretic issue regarding the relationship between operators on the lattice and in the continuum. The phase diagram of SU(3) lattice gauge theories with light fermions was investigated as a function of the gauge coupling and the fermion mass. A formulation of higher derivative gravity on a simplicial lattice was developed. Analytical and numerical work was carried out in two- and four-dimensional lattice gravity to study the phase diagram of the theory, the existence of nontrivial fixed points, and the question of the renormalization of the cosmological constant. A study was conducted on hadronic decay amplitudes in lattice gauge theory. Other studies conducted include: a covariant functional Schroedinger formalism for quantum field theory in curved space-time, constraints on magnetic mass, anomalies in reparameterization invariance in Type I superstrings, the Wess-Zumino action as an effective description of the anomalies of a theory, quantum fluctuations that can produce small regions of chirally symmetric phase in QCD, and supersymmetry anomalies. DOE

**N86-23386#** Rochester Univ., N. Y. Dept. of Chemistry.
**LOW ENERGY ION-MOLECULE REACTION DYNAMICS AND CHEMIIONIZATION KINETICS Progress Report, 1 Feb. 1985 - 31 Jan. 1986**
J. M. Farrar 1985 10 p
(Contract DE-AC02-78ER-04694)
(DE86-001853; DOE/ER-04694/2) Avail: NTIS HC A02/MF A01

Topics covered in this Rochester University, Department of Chemistry, progress report include proton transfer reactions, carbon cation reactions, metal ion chemistry, reactive scattering from double minimum potentials, and oxygen-minus reactive scattering. DOE

**N86-22745#** Joint Publications Research Service, Arlington, Va.
**VELOCITY DISTRIBUTION OF ATOMIC BEAMS MEASURED**
Yuzhu Wang, Yudan Cheng, Shanyu Zhou, Weigang Huang, and Liang Liu *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 21-25 refs Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 11, 20 Nov. 1985 p 658-660 (For primary document see N86-22741 13-31) Avail: NTIS HC A04/MF A01

# 73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

**N86-23387** Stanford Univ., Calif.
**NEW SOURCES OF COHERENT RADIATION BY RELATIVISTIC ELECTRONS Ph.D. Thesis**
Chi Keng Chen 1985 126 p
Avail: Univ. Microfilms Order No. DA8522125

Coherent radiation generation relativistic electrons has the potenial advantage of being of higher efficiency, and more broadly tunable than the conventional laser sources. The following new coherent radiation sources were investigated: stimulated synchrotron radiation, dispersive free electron laser, and two cavity optical klystron. The stimulated synchrotron radiation process occurs when electrons and an electromagnetic wave propagate approximately in the same direction in a transverse magnetic field. The dispersive free electron laser (dispersive FEL) is a normal free electron laser (FEL) with a dispersive magnetic field superimposed on some of the undulator magnets. The two cavity optical klystron is a modified optical klystron where the modulation and energy extraction section have separate cavities. The three sources are compared and evaluated. Dissert. Abstr.

**N86-23388*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**SYMMETRY CONSIDERATIONS IN THE SCATTERING OF IDENTICAL COMPOSITE BODIES**
John W. Norbury (Old Dominion Univ., Norfolk, Va.), Lawrence W. Townsend, and Philip A. Deutchman (Idaho Univ., Moscow) 1986 19 p refs
(NASA-TP-2548; L-16035; NAS 1.60:2548) Avail: NTIS HC A02/MF A01 CSCL 20H

Previous studies of the interactions between composite particles were extended to the case in which the composites are identical. The form of the total interaction potential matrix elements was obtained, and guidelines for their explicit evaluation were given. For the case of elastic scattering of identical composites, the matrix element approach was shown to be equivalent to the scattering amplitude method. Author

**N86-23389#** Stanford Linear Accelerator Center, Calif.
**MEASUREMENT OF THE DECAY UPSILON(2S) (YIELDS) (PI)(0) (PI)(0)UPSILON(1S)**
D. M. Gelphman Sep. 1985 63 p
(Contract DE-AC03-76SF-00515)
(DE86-001927; SU-SLAC-286) Avail: NTIS HC A04/MF A01

The hadronic transitions UPSILON(2S) (YIELDS) (PI)(0)(PI) UPSILON(1S) (YIELDS) (GAMMA)(GAMMA)(GAMMA)(GAMMA)l(+ )l(-) (l = (MU) or e) are investigated using the Crystal Ball detector. The analysis is based on 193,000 UPSILON(2S) events produced at the DORIS II e(+)e(-) storage ring from November 1982 to February 1984. We observe 44 events with a muon pair and 46 events with an electron pair in the final state. The signals in both channels are relatively background free. Assuming lepton universality, we average the results for the two channels and obtain the product branching ratio B(UPSILON(2S) (YIELDS) (PI)(0)(PI)(0) UPSILON(1S)) x B/sub ll/(UPSILON(1S)) = (2.3 +0.3 +- 0.3) x 10(-3) where the first error is statistical and the second is systematic. Using the present world average value of B(sub ll)(UPSILON(1S)) = (2.9 +- 0.3)% we derive a branching ratio B(UPSILON(2S) (YIELDS) (PI)(0)(PI)(0)UPSILON(1S)) = (8.0 +- 1.5)% where the statistical and systematic errors have been added in quadrature. This result is compared with previous results for the charged pion transitions UPSILON(2S) (YIELDS) (PI)(+)(PI)(-) UPSILON(1S) and with the expectation from theory. DOE

**N86-23390#** Texas A&M Univ., College Station.
**STUDY OF THE NEUTRON-PROTON INTERACTION IN THE 300 TO 700 MeV ENERGY REGION Annual Progress Report, 1984 - 1985**
L. C. Northcliffe 1985 20 p refs
(Contract DE-AS05-76ER-04449)
(DE86-001953; DOE/ER-04449/53) Avail: NTIS HC A02/MF A01

The principal activities during the past year have included five months of data taking to complete LAMPF Experiment No. 665 (The Measurement of the Initial State Spin Correlation Parameters C(sub LL) and C(sub SL) in n-p elastic scattering at 500, 650 and 800 MeV) and preparations for LAMPF Experiment No. 770 (The

Measurement of np Elastic Scattering Spin Correlation Parameters with L- and S-Type Polarized Beam and Target between 500 and 800 MeV). The latter experiment is running now and is scheduled for completion late in October, when preparations will begin for LAMPF Experiment No. 589 (Free Forward np Elastic Scattering Analyzing Power Measurement at 800 MeV), which is scheduled to run in November. DOE

**N86-23391#** California Univ., Berkeley. Lawrence Berkeley Lab.
**REACTION HAMILTONIAN AND STATE-TO-STATE DESCRIPTION OF CHEMICAL REACTIONS**
B. A. Ruf, V. Z. Kresin, and W. A. Lester, Jr. Aug. 1985 39 p refs Presented at the 5th International Congress on Quantum Chemistry, Montreal, Quebec, 19 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002006; LBL-20112; CONF-850859-1) Avail: NTIS HC A03/MF A01

A chemical reaction is treated as a quantum transition from reactants to products. A specific reaction Hamiltonian (in second quantization formalism) is introduced. The approach leads to Franck-Condon-like factor, and adiabatic method in the framework of the nuclear motion problems. The influence of reagent vibrational state on the product energy distribution has been studied following the reaction Hamiltonian method. Two different cases (fixed available energy and fixed translational energy) are distinguished. Results for several biomolecular reactions are presented. DOE

**N86-23392#** New York Univ., New York. Courant Inst. of Mathematical Sciences.
**COMPUTATIONAL METHODS FOR THE NUCLEAR AND NEUTRON MATTER PROBLEM Progress Report**
M. H. Kalos, J. Carlson, R. Panoff, and K. Schmidt Oct. 1985 42 p refs
(Contract DE-AC02-79ER-10353)
(DE86-002052; DOE/ER-10353/7) Avail: NTIS HC A03/MF A01

A new method is presented for treating fermion systems by Monte Carlo methods. This method is based on the concept of a mirror potential, which is a many-body potential that forces the Monte Carlo iteration to have a stable anti-symmetric component. The potential may be determined from the wave function and, within the framework of Green's Function Monte Carlo (GFMC), from the random walk whose density converges to the wave function. Further work has been given to the variational study of light nuclei. In particular, microscopic calculations of alpha-neutron scattering were performed. Techniques were also developed for performing variational calculations of heavier nuclei interacting with realistic interactions. A series of calculations on liquid He-3 at its experimental equilibrium density has also been done. DOE

**N86-23393#** Colorado Univ., Boulder.
**REVISED FIELD PINCH EXPERIMENTS Annual Progress Report, 1 Jun. 1984 - 31 May 1985**
S. Robertson 1985 38 p
(Contract DE-AC02-83ER-53164)
(DE86-002460; DOE/ER-53164/1) Avail: NTIS HC A03/MF A01

The dielectric breaks in the Reversatron vacuum chamber were replaced by bellows sections in December 1984, and operation was resumed in January 1985. The plasma current was limited to 20 kA due to the inefficiency of the air-core transformer. RFP discharges were not obtained due to the pinch parameter theta being below the required value of 1.6. Diagnostics indicated n approx. 4 x 10 to the -13 power/cu cm and T(sub e) approx. 75 eV. Inductively decoupled vertical field coils were used to vary the equilibrium position of the plasma and to maximize the plasma current. A new air-core transformer is being installed which will give an increased plasma current and pinch parameter. Operation with the shell in place will begin in June 1985. If adequate theta values and RFP discharges are obtained, operation without the shell will begin in October 1985. DOE

**N86-23394#** State Univ. of New York, Stony Brook.
**EXPERIMENTAL HIGH ENERGY PHYSICS RESEARCH USING ELECTROMAGNETIC ENERGY CALORIMETRY Progress Report**
M. D. Marx 1985 33 p
(Contract DE-AC02-80ER-10699)
(DE86-002466; DOE/ER-10699/5) Avail: NTIS HC A03/MF A01

Present research is concentrated on two major efforts - E734, the neutrino experiment at Brookhaven; and DO, the second generation collider experiment at Fermilab. E734 is in a mature phase, producing highly topical results on weak neutral current parameters, neutrino spectra and oscillations, with a final data run expected this year. DO, in its infancy, received this year formal DOE approval and high national priority ranking, and is currently in an R and D and design phase with major component construction to start next fiscal year. DOE

**N86-23395#** UNC Nuclear Industries, Inc., Richland, Wash.
**COMPILATION OF CARBON-14 DATA**
R. A. Paasch Jul. 1985 64 p
(Contract DE-AC06-76RL-01857)
(DE85-015170; UNI-3499) Avail: NTIS HC A04/MF A01

A review and critical analysis was made of the original sources of carbon-14 in the graphite moderator and reflector zones of the eight Hanford production reactors, the present physical and chemical state of the carbon-14, pathways (other than direct combustion) by which the carbon-14 could be released to the biosphere, and the maximum rate at which it might be released under circumstances which idealistically favor the release. Areas of uncertainty are noted and recommendations are made for obtaining additional data in three areas: (1) release rate of carbon-14 from irradiated graphite saturated with aerated water; (2) characterization of carbon-14 deposited outside the moderator and reflector zones; and (3) corrosion/release rate of carbon-14 from irradiated steel and aluminum alloys. DOE

**N86-23396#** Los Alamos National Lab., N. Mex.
**STUDY OF NEUTRON NOISE FROM REFLECTED, METAL ASSEMBLIES WITH CRITICALITY SAFETY APPLICATIONS IN MIND**
C. S. Barnett 20 Aug. 1985 43 p Presented at the DOE Subcritical Reactivity Measurements Workshop, Albuquerque, N. Mex., 26 Aug. 1985
(Contract W-7405-eng-48)
(DE85-017273; UCRL-93219; CONF-8508105-1) Avail: NTIS HC A03/MF A01

The statistics of detected neutrons that leaked from four subcritical reflected, enriched-uranium assemblies, are studied to explore the feasibility of developing a criticality warning system based on neutron noise analysis. The calculated multiplication factors of the assemblies are 0.59, 0.74, 0.82, and 0.92. Three possible discriminators are considered, i.e., three signatures that might be used to discriminate among assemblies of various multiplications. They are: (1) variance-to-mean ratio of the counts in a time bin (V/M); (2) covariance-to-mean ratio of the counts in a common time bin from two different detectors (C/M); and (3) covariance-to-mean ratio of the counts from a single detector in two adjacent time bins of equal length, which called the serial-covariance-to-mean ratio (SC/M). The performances of the three discriminators were not greatly different, but a hierarchy did emerge: SC/M greater than or equal to V/M greater than or equal to C/M. DOE

**N86-23397#** Department of Energy, Washington, D. C.
**CONTROL SYSTEM FOR A SMALL FISSION REACTOR Patent Application**
J. P. Burelbach, W. J. Kann, and J. G. Salveau, inventors (to DOE) Filed Feb. 1985 20 p
(Contract W-31-109-eng-38)
(DE85-017798; US-Patent-Appl-SN-699887) Avail: NTIS HC A02/MF A01

A system for controlling the reactivity of a small fission reactor includes an elongated, flexible hollow tube in the general form of a helical coiled spring axially positioned around and outside of the reactor vessel in an annular space between the reactor vessel and a surrounding cylindrical-shaped neutron reflector. A neutron

absorbing material is provided within the hollow tube with the rate of the reaction controlled by the extension and compression of the hollow tube, e.g., extension of the tube increases reactivity while its compression reduces reactivity, in varying the amount of neutron absorbing material disposed between the reactor vessel and the neutron reflector. Conventional mechanical displacement means may be employed to control the coil density of the hollow tube as desired. DOE

**N86-23398#** Stanford Linear Accelerator Center, Calif.
**GROUND MOTION AND ITS EFFECTS IN ACCELERATOR DESIGN**
G. E. Fischer Jul. 1985 77 p Presented at the US Summer School on High Energy Particle Accelerator, Batavia, Ill., 13 Aug. 1984
(Contract DE-AC03-76SF-00515)
(DE86-001143; SU-SLAC-PUB-3392-Rev; CONF-840873-1-Rev) Avail: NTIS HC A05/MF A01

The effects of ground motion on accelerator design are discussed. The limitations on performance are discussed for various categories of motion. For example, effects due to ground settlement, tides, seismic disturbances and man-induced disturbances are included in this discussion. DOE

**N86-23399#** Stanford Linear Accelerator Center, Calif.
**PLANS FOR POLARIZED BEAMS AT THE SLC**
C. Y. Prescott Jul. 1985 12 p refs Presented at the Workshop on Tests of Electroweak Theories, Polarized Processes and Other Phenomena, Trieste, Italy, 10 Jun. 1985
(Contract DE-AC03-76SF-00515)
(DE86-001452; SU-SLAC-PUB-3728; CONF-8506204-1) Avail: NTIS HC A02/MF A01

Precision tests of the electroweak interactions will soon be possible at the SLC and LEP. The SLC will be capable of providing longitudinal polarization of one incoming beam, the electrons, for such tests. Plans at the SLC to provide and monitor these beams are described, and some physics objectives are discussed. DOE

**N86-23400#** Stanford Linear Accelerator Center, Calif.
**TOPONIUM-Z(0) INTERFERENCE**
P. J. Franzini Sep. 1985 5 p Presented at the Meeting of the Particles and Fields Division of the American Physical Society, Eugene, Oreg., 12 Aug. 1985
(Contract DE-AC03-76SF-00515)
(DE86-001458; SU-SLAC-PUB-3763; CONF-850869-4) Avail: NTIS HC A02/MF A01

A study of interference of the Z(0) boson and toponium states is presented. The simple case of the Z(0) mixing with one t anti t state is discussed in detail. Effects of mixing with the full t anti t spectrum, of the smearing due to beam spread, and of different potentials, are then shown. DOE

**N86-23401#** Lawrence Livermore National Lab., Calif.
**PERSONNEL NEUTRON DOSIMETRY USING HOT, LOW-FREQUENCY ELECTROCHEMICAL ETCHING**
D. E. Hankins, S. G. Homann, and J. M. Davis 19 Sep. 1985 5 p refs Presented at the 13th International Conference on Solid State Nuclear Track Detectors, Rome, Italy, 23 Sep. 1985
(Contract W-7405-eng-48)
(DE86-001561; UCRL-92652; CONF-850933-2) Avail: NTIS HC A02/MF A01

We have developed an electrochemical-etch procedure for the processing of large numbers of CR-39 dosimeters. Specially designed Homann-Type chambers can etch up to 24 CR-39 chips, or foils, at one time. In our two-step procedure, the second step, called blow-up, increases the tracks' size and makes them relatively uniform. The energy response is fairly flat from approx. 150 keV to 4.5 MeV, but drops by about a factor of three in the 13 to 16 MeV range. The sensitivity of the dosimetry system is 6 tracks/mrem with a background of 8 mrem, giving a lower limit of sensitivity of approximately 10 mrem for the dosimeter (when three foils are used). Because greater numbers of CR-39 foils can be accommodated at any one time, our procedure is quite efficient for operations with large numbers of dosimeters to be processed. DOE

**N86-23402#** Georgia Univ., Athens. Dept. of Physics and Astronomy.
**NUCLEON-NUCLEUS AND ANTINUCLEON-NUCLEUS SCATTERING AT INTERMEDIATE ENERGIES**
W. G. Love, A. Klein, and M. A. Franey 1985 23 p refs Presented at the Conference on Antinucleon and Nucleon-nucleus Interactions, Telluride, Colo., 18 Mar. 1985 Prepared in cooperation with Minnesota Univ., Minneapolis
(Contract DE-AC02-77ER-04215)
(DE86-001590; CONF-850315-12) Avail: NTIS HC A02/MF A01

Those aspects of nucleon-nucleon (NN) and antinucleon-nucleon (anti N N) couplings which appear to be most important for the calculation and interpretation of N-nucleus and anti N-nucleus scattering at intermediate energies are compared and discussed within a single scattering approximation based on the free NN and anti N N t-matrices. The role of distortion considerations is stressed and, in the case of nucleon scattering, medium corrections to the NN coupling embodied in a nuclear matter G-matrix approach are illustrated and some of their implications are discussed. Some of the most important characteristics of nucleons and antinucleons as probes of nuclear structure are illustrated explicitly in distorted wave calculations of inelastic scattering and charge exchange reactions. DOE

**N86-23403#** European Organization for Nuclear Research, Geneva (Switzerland).
**LARGE TRANSVERSE MOMENTUM (PI)(0) PRODUCTION IN (ALPHA)(ALPHA), dd AND pp COLLISIONS AT THE CERN ISR**
A. L. S. Angelis, G. Basini, H. J. Besch, R. E. Breedon, L. Camilleri, T. J. Chapin, C. Chasman, R. L. Cool, P. T. Cox, and C. vonGagern 1985 13 p Presented at the International Europhysics Conference on High Energy Physics, Bari, Italy, 18 Jul. 1985
(Contract DE-AC02-81ER-40033)
(DE86-001628; DOE/ER-40033/88; CONF-850721-9) Avail: NTIS HC A02/MF A01

Results on the invariant cross-section of (PI)(0)-mesons produced in (ALPHA)(ALPHA), pp and dd collisions will be presented. The measurements were made at a centre-of-mass energy per nucleon pair of 31 GeV and in the transverse momentum range 3 $<$ P sub t/ $<$ 8 GeV/c. The data show a very clear anomalous nuclear enhancement in (ALPHA)(ALPHA) collisions whereas no such effect is observed in dd collisions. DOE

**N86-23404#** Brookhaven National Lab., Upton, N. Y.
**RELATIVISTIC HEAVY IONS AT BROOKHAVEN: HIGH ENERGY NUCLEAR BEAMS IN THE AGS AND RHIC**
T. W. Ludlam 1985 22 p refs Presented at the 2nd International Conference on Nucleus-nucleus Collisions, Visby, Sweden, 10 Jun. 1985
(Contract DE-AC02-76CH-00016)
(DE86-001725; BNL-37083; CONF-850672-7) Avail: NTIS HC A02/MF A01

The design and proposed experiments are presented for the Relativistic Heavy Ion Collider at Brookhaven. The plans are to begin with relatively light ions (A approx. = 32amu) and to extend over the mass range to A = 200. With these relativistic beams one will be able to investigate thermodynamic conditions with near-zero baryon number which can be compared with quantum chromodynamics. DOE

**N86-23405#** Brookhaven National Lab., Upton, N. Y.
**SYNCHROTRON RADIATION DAMAGE OBSERVATIONS IN NORMAL INCIDENCE COPPER MIRRORS**
P. Z. Takacs, J. Melendez, and J. Colbert Aug. 1985 21 p Presented at the 2nd International Synchrotron Radiation Instrumentation Conference, Stanford, Calif., 29 Jul. 1985
(Contract DE-AC02-76CH-00016)
(DE86-001732; BNL-37042; CONF-850734-16) Avail: NTIS HC A02/MF A01

Water-cooled copper mirrors used at near-normal incidence

on two beam lines at the NSLS are observed to undergo severe degradation upon exposure to the direct SR beam. These mirrors are used on beam lines designed to utilize radiation in the wavelength regions longer than 100 nm and are coated with a UV reflection-enhancing coating, consisting of one or more bilayers of aluminum with a MgF2 overcoat. Beamline performance degrades very rapidly following installation of a new set of mirrors. Analysis of the mirror surfaces by various non-destructive techniques indicates severe degradation of the coating and surface along the central strip where most of the X-ray power is absorbed from the beam. In one case where the mirror had three bilayer coatings, the outer coating layer has disappeared along the central strip. Rutherford backscatter measurements indicate compositional changes between layers and confirm the existence of a carbon deposit on the surface. Thermal modeling suggests that most of the damage is caused by direct photon interaction, since the temperature rise in the energy deposition region is small. DOE

**N86-23406#** Pacific Northwest Lab., Richland, Wash.
**BETA FIELDS AND MEASUREMENT PRACTICES AT DOE FACILITIES**
K. L. Swinth, L. A. Rathbun, and L. W. Brackenbush Sep. 1985 27 p refs Presented at the Workshop on Dosimetry of Beta Particles and Low Energy X-rays, Paris, France, 7 Oct. 1985
(Contract DE-AC06-76RL-01830)
(DE86-001770; PNL-SA-13458; CONF-8510185-1) Avail: NTIS HC A03/MF A01

As part of a larger program, the beta measurement problem at DOE facilities was assessed through the use of a questionnaire and field visits to selected facilities. At 35% the facilities beta-emitting radionuclides can contribute enough to the radiation exposures that they must be considered in establishing protection requirements. Measurements were made in several facilities using scintillators, a surface barrier detector plus various dosimeters and survey instruments. Beta dose rates of several hundred mrad/hr were not unusual and beta:gamma ratios of greater than 30:1 were frequently observed. The agreement between the various measurement techniques was frequently unacceptable. DOE

**N86-23407#** Argonne National Lab., Ill.
**DIFFRACTION SCATTERING AND THE PARTON MODEL IN QCD**
A. White 1985 19 p Presented at the Workshop on Elastic and Diffractive Scattering At the Collider, Chateau de Blois, France, 3 Jun. 1985
(Contract W-31-109-eng-38)
(DE86-001792; CONF-8506197-2) Avail: NTIS HC A02/MF A01

Arguments are presented that the validity of the parton model for hadron scattering in QCD is directly related to the occurrence of the Critical Pomeron description of diffraction scattering. An attractive route suggested for Electroweak and Grand Unification is also briefly described. DOE

**N86-23408#** Argonne National Lab., Ill.
**POLARIZATION PHENOMENA IN NUCLEON-NUCLEON SCATTERING AT INTERMEDIATE AND HIGH ENERGIES INCLUDING THE PRESENT STATUS OF DIBARYONS**
A. Yokosawa 1985 30 p refs Presented at the 6th International Symposium on Polarization Phenomena in Nuclear Physics, Osaka, Japan, 26 Aug. 1985
(Contract W-31-109-eng-38)
(DE86-001799; ANL-HEP-CP-85-93; CONF-850807-10) Avail: NTIS HC A03/MF A01

We review experimental results concerning polarization phenomena in nucleon-nucleon scattering in which both the elastic scattering and hadron-production reaction are included. We also present summary of S = 0 dibaryon resonances and candidates by reviewing experimental data in the nucleon-nucleon system, (GAMMA)d channel, (PI)d elastic scattering, pp (YIELDS) (PI)d channel, deuteron break-up reactions, and narrow structures in missing-mass spectra. DOE

**N86-23409#** Florida Univ., Gainesville. Dept. of Physics.
**INTRODUCTION TO THE THEORY OF RELATIVISTIC STRINGS**
C. B. Thorn 1985 42 p Presented at the Workshop on Unified String Theories, Santa Barbara, Calif., 29 Jul. 1985
(Contract DE-AS05-81ER-40008)
(DE86-001950; DOE/ER-40008/77; CONF-850798-1) Avail: NTIS HC A03/MF A01

In these lectures we review the theory of relativistic bosonic strings. After a discussion of the classical string, we describe the quantum string using the light-cone parametrization of Goddard, Goldstone, Rebbi, and Thorn. We then discuss Lorentz covariant quantization and give an improved version of the Goddard-Thorn proof of the No-ghost Theorem. Finally, we discuss interacting strings as the continuum limit of an interacting discretized string theory following ideas of Giles and Thorn. We evaluate the continuum limit of the lowest order contribution to a simple process and explain how the critical dimension is singled out as the one for which this limit is finite. We present the string field equations in light-cone gauge with the discrete regularization in place, and we discuss the classical limit of those equations. DOE

**N86-23410#** California Univ., Berkeley. Lawrence Berkeley Lab.
**ANGULAR DISTRIBUTION OF UNDULATOR POWER FOR AN ARBITRARY DEFLECTION PARAMETER K**
K. J. Kim Aug. 1985 14 p Presented at the 2nd International Synchrotron Radiation Instrumentation Conference, Stanford, Calif., 29 Jul. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001994; LBL-20167; CONF-850734-15) Avail: NTIS HC A02/MF A01

A calculation of the angular distribution of power generated from an undulator, integrated over all frequencies, is presented. The result, valid for any arbitrary value of the deflection parameter K, reduces to the known expressions in the cases K (YIELDS) infinity and K (YIELDS) 0. DOE

**N86-23411#** Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.
**DOUBLY DIFFERENTIAL CROSS SECTIONS OF COLLISION-PRODUCED FORWARD ELECTRON EMISSION**
S. B. Elston 1985 15 p refs Presented at the 14. International Conference on the Physics of Electronic and Atomic Collisions, Palo Alto, Calif., 24 Jul. 1985 Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract DE-AC05-84OR-21400)
(DE86-002200; CONF-850701-4) Avail: NTIS HC A02/MF A01

The velocity space distribution of electrons emitted near the forward direction from collisions involving fast, highly stripped oxygen ions with gaseous and solid targets is presented and described in terms of multipole moments of the ejected charge distribution, which permits direct comparison with recent theory. The results are from a novel apparatus permitting rapid and efficient data acquisition by employing position-sensitive electron detection to combine angle definition with conventional electrostatic spectrometry. Excellent agreement is obtained between distribution observed for electron loss to projectile continuum processes and recent theory in the case of argon targets; less favorable results for simpler helium targets may indicate the need for theoretical study of higher order inelastic processes in that case. The multipole content observed with a solid target is consistent with a conceptual model of convoy electron production dominated by electron loss from the projectile within the bulk of the target and may signify the importance of steady-state production of excited states within the bulk solid. DOE

**N86-23412#** Oak Ridge National Lab., Tenn.
**EXPERIMENTS ON ELECTRON-IMPACT EXCITATION AND IONIZATION OF IONS**
R. A. Phaneuf 1985 66 p Presented at the NATO Advanced Study Institute on Physics of Electron-ion and Ion-ion Collisions, Han sur Lesse, Belgium, 30 Sep. 1985
(Contract DE-AC05-84OR-21400)

(DE86-002220; CONF-8509196-1) Avail: NTIS HC A04/MF A01

The present review covers some of the fundamental aspects of electron-impact ionization. Highlights are described of some of the important experimental results which have been produced since 1981. DOE

**N86-23413#** Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik.

**POINT CONTACT SPECTROSCOPY OF HEAVY FERMIONS**

M. Moser, P. Wachter, J. J. M. Franse, G. P. Meisner, and E. Walker 1985 11 p Presented at the International Conference on Magnetism, San Francisco, Calif., 26 Aug. 1985 Prepared in cooperation with Amsterdam Univ., Netherlands, Geneva Univ., Switzerland and Los Alamos National Lab., N. Mex.

(Contract W-7405-eng-36)

(DE86-002431; LA-UR-85-3828; CONF-850890-22) Avail: NTIS HC A02/MF A01

Point contact spectroscopy (PCS) has been performed on the heavy fermion systems CeAl3, CeCu6, UPt3, U6Co and U2PtC2. The dynamical resistance dU/dI is a function of the electronic density of states (EDS) at E/sub F/. The width of the EDS inferred from the PC measurements can be compared with the (GAMMA)-value of the specific heat. DOE

**N86-23414#** Iowa State Univ. of Science and Technology, Ames.

**SIZES AND SHAPES OF SHORT-LIVED NUCLEI VIA LASER SPECTROSCOPY Final Report**

D. A. Lewis Oct. 1985 20 p refs

(Contract DE-AC02-79ER-10496)

(DE86-002795; DOE/ER-10496/6) Avail: NTIS HC A02/MF A01

This project, a collaboration involving Iowa State University, Argonne National Lab., and the University of Minnesota, was aimed at the determination of properties of short-lived nuclei through their atomic hyperfine structure and optical isotope shifts. The basic approach was to use a cryogenic He-jet system to thermalize, neutralize, and transport radioactive nuclei produced online into a region suitable for laser spectroscopy. The photon burst method was then used for high sensitivity with the resulting continuous atomic beam. The experiment was located on beamline of the ANL superconducting heavy-ion accelerator. The He-jet system developed would reliably transport approx. 10(2) nuclei into phase space useful for high resolution laser spectroscopy. The laser system developed could accurately and reproducibly sweep small frequency ranges for periods greater than or equal to 1 day and sensitivity limits less than or equal to 1 atom/s were achieved. However the nuclei were not transported as free atoms precluding nuclear determinations. Attempts to obtain free atoms by eliminating turbulence and contamination were not successful. DOE

**N86-23415#** Los Alamos National Lab., N. Mex.

**ON RF BEAM-CURRENT, -PHASE AND -POSITION MONITORS**

L. Young 12 Dec. 1984 12 p

(Contracts DE-AT01-79ER10527; W-7405-eng-36)

(DE86-002847; DOE/ER-10527/T6) Avail: NTIS HC A02/MF A01

A prototype RF beam monitor has been tested on the Racetrack Microtron's (RTM) 100 kV injector beam line at the National Bureau of Standards (NBS). This beam monitor is capable of measuring the current, the relative phase, and the position of the beam. The beam is bunched at 2380 MHz for acceleration by the linac in the injector beam line. This train of beam bunches passing through the beam monitor cavities excites the cavities at this resonance frequency of 2380 MHz. Probes in the cavities couple some of the beam-excited rf power out of the cavities. This RF power can be amplified if necessary and then analyzed by a double balanced mixer (DBM). The DBM can also be used as a phase detector. The effective shunt impedance of the cavities was measured with the CW beam. For the position monitor cavity, the shunt impedance is proportional to the displacement from the axis. The measured response of the prototype RF beam current monitor setup is a linear function of beam current. Response of the RF beam-position monitor is also shown. DOE

**N86-23416#** Sandia National Labs., Albuquerque, N. Mex.

**TWO CAVITY AUTOACCELERATION OF AN INTENSE RELATIVISTIC ELECTRON BEAM**

P. D. Coleman and T. R. Lockner 1985 8 p Presented at the Antigone and Delphi Workshop, Livermore, Calif., 23 Oct. 1985

(Contract DE-AC04-76DP-00789)

(DE86-002914; SAND-85-2315C; CONF-8510191-2) Avail: NTIS HC A02/MF A01

Two autoacceleration cavities have been used to accelerate an 11-kA electron beam from 2 MeV to approx. =2.8 MeV. The two 40-(UC OMEGA) cavities each accelerated the beam by approx. =400 kV with no observable interaction between the two cavities over several cavity transmit times. DOE

**N86-23417#** Lawrence Livermore National Lab., Calif.

**SHELL-MODEL CALCULATIONS OF BETA-DECAY RATES FOR s- AND r-PROCESS NUCLEOSYNTHESES**

K. Takahashi, G. J. Mathews, and S. D. Bloom Oct. 1985 6 p refs Presented at the 190th American Chemical Society National Meeting, Chicago, Ill., 8 Sep. 1985

(Contract W-7405-eng-48)

(DE86-002988; UCRL-93518; CONF-850942-37) Avail: NTIS HC A02/MF A01

Examples of large-basis shell-model calculations of Gamow-Teller (BETA)-decay properties of specific interest in the astrophysical s- and r- processes are presented. Numerical results are given for: (1) the GT-matrix elements for the excited state decays of the unstable s-process nucleus Tc-99; and (2) the GT-strength function for the neutron-rich nucleus Cd-130, which lies on the r-process path. The results are discussed in conjunction with the astrophysics problems. DOE

**N86-23418#** Houston Univ., Tex.

**COMMENTS ON THE EXISTENCE OF STRANGE DIBARYONS**

E. V. Hungerford 1985 18 p refs

(Contract DE-AS05-76ER-03948)

(DE86-003460; DOE/ER-03948/T3) Avail: NTIS HC A02/MF A01

The present status and future prospects for strange dibaryon observation is reviewed. DOE

**N86-23419#** Massachusetts Inst. of Tech., Cambridge.

**BEAM BRIGHTNESS FROM A RELATIVISTIC, FIELD-EMISSION DIODE WITH A VELVET COVERED CATHODE**

G. Bekefi, R. E. Shefer, and S. C. Tasker Aug. 1985 15 p refs Presented at the 7th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985

(Contract W-7405-eng-48)

(DE86-001112; CONF-850956-12) Avail: NTIS HC A02/MF A01

The beam emittance and brightness from a mildly relativistic (200 to 400 kV) high current density (0.5 to 3.5 kA/sq cm) planar, field emission diode provided with a velvet covered cathode have been studied experimentally as a function of the applied electric field (100 to 600 kV/cm). Transverse beam spreading has been measured using a conventional pinhole arrangement followed by a fluorescent screen and open shutter camera. Good turn-on, and a high normalized beam brightness (B(sub n) = 300 kA/sq cm-rad sq) have been observed. The results are compared with those obtained with a graphite cathode. DOE

**N86-23420#** Stanford Linear Accelerator Center, Calif.

**T-EXPANSION: A SHORT REVIEW**

M. Karliner Sep. 1985 7 p refs Presented at the Nuclear Chromodynamics Conference, Santa Barbara, Calif., 12 Aug. 1985

(Contract DE-AC03-76SF-00515)

(DE86-001459; SU-SLAC-PUB-3779; CONF-8508127-3) Avail: NTIS HC A02/MF A01

The t-expansion is a nonperturbative calculational tool recently developed for Hamiltonian systems. A short review of the method is given. It is followed by a summary of applications to two dimensional spin systems and to four dimensional non-abelian lattice gauge theories. DOE

**N86-23421#** Lawrence Livermore National Lab., Calif.
**NUMERICAL DETERMINATION OF INJECTOR DESIGN FOR HIGH BEAM QUALITY**
J. K. Boyd 15 Oct. 1985 12 p Presented at the 7th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract W-7405-eng-48)
(DE86-002373; UCRL-93456; CONF-850956-9) Avail: NTIS HC A02/MF A01

The performance of a free electron laser strongly depends on the electron beam quality or brightness. The electron beam is transported into the free electron laser after it has been accelerated to the desired energy. Typically the maximum beam brightness produced by an accelerator is constrained by the beam brightness deliverd by the accelerator injector. Thus it is important to design the accelerator injector to yield the required electron beam brightness. The DPC (Darwin Particle Code) computer code has been written to numerically model accelerator injectors. DPC solves for the transport of a beam from emission through acceleration up to the full energy of the injector. The relativistic force equation is solved to determine particle orbits. Field equations are solved for self consistent electric and magnetic fields in the Darwin approximation. DPC has been used to investigate the beam quality consequences of A-K gap, accelerating stress, electrode configuration and axial magnetic field profile. DOE

**N86-23422#** Lawrence Livermore National Lab., Calif.
**PROPERTIES OF THE ACCELERATOR-PRODUCED BEAM**
G. J. Caporaso, F. W. Chambers, A. G. Cole, W. M. Fawley, and K. W. Struve 11 Oct. 1985 19 p Presented at the SDIO/DARPA Annual Propagation Review, Monterey, Calif., 24 Jun. 1985
(Contract W-7405-eng-48)
(DE86-002374; UCRL-92873; CONF-8506141-14) Avail: NTIS HC A02/MF A01

Obtaining detailed knowledge of the condition of the electron beam delivered to the experimental tank is of prime importance in the attempt to correlate the propagation data with theory. There are many interesting and unique features of the beam delivered by Advanced Test Accelerator (ATA) to the experimental tank. DOE

**N86-23423#** Los Alamos National Lab., N. Mex.
**RUN PERMIT SOFTWARE FOR THE PROTON STORAGE RING**
S. S. Bair 1985 14 p Presented at the 2nd International Workshop on Accelerator Control Systems, Los Alamos, N. Mex., 7 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002395; LA-UR-85-3584; CONF-8510194-2) Avail: NTIS HC A02/MF A01

The Run Permit system is intended to protect equipment from radiation effects caused by having beam enabled when required equipment is not operational. This system will not allow beam unless certain devices are ready and will drop beam if any of these devices become inoperative. A system to provide such protection might be implemented in hardware. However, because the several operating modes of the Proton Storage Ring/Weapons Neutron Research facility require certain devices to be in different states (depending on mode), a dynamic configuration capability is needed, that is, a software solution is more feasible. DOE

**N86-23424#** Los Alamos National Lab., N. Mex.
**PROTON STORAGE RING: MAN/MACHINE INTERFACE**
R. F. Lander and P. N. Clout 1985 26 p Presented at the 2nd International Workshop on Accelerator Control Systems, Los Alamos, N. Mex., 7 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002397; LA-UR-85-3582; CONF-8510194-5) Avail: NTIS HC A03/MF A01

The human interface of the Proton Storage Ring Control System at Los Alamos is described in some detail, together with the software environment in which operator interaction programs are written. Some examples of operator interaction programs are given. DOE

**N86-23425#** Brookhaven National Lab., Upton, N. Y.
**STUDIES OF POSITIONAL STABILITY OF THE ELECTRON BEAM IN THE NSLS STORAGE RING**
L. H. Yu, R. J. Nawrocky, and J. Galayda 1985 4 p Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract DE-AC02-76CH-00016)
(DE86-002505; BNL-36561; CONF-850504-293) Avail: NTIS HC A02/MF A01

The beam position monitor used at NSLS is described, with a resolution of 1 (MU)m without considering mirror vibration. An upper limit of the resolution is 11 (micro)m, given by a preliminary measurement of mirror angular vibration. Further improvement of this measurement can lower the upper limit. Preliminary result of long term beam movement and vibration of beam position is reported. These measurements are correlated with ambient and controlled mechanical vibration of a quadrupole. The 60 Hz vibration seems unlikely to be caused by quadrupole mechanical vibration, but 12 Hz beam vibration can be accounted for by this vibration. In time, correlation with ambient and controlled electrical variation will be measured. These measurements and more efforts on monitors at other beam ports to locate noise source are under way. DOE

**N86-23426#** Los Alamos National Lab., N. Mex.
**POTENTIAL ENERGY FOR QUARKS**
L. Heller 1985 17 p refs Presented at the Nuclear Chromodynamics Conference, Santa Barbara, Calif., 12 Aug. 1985
(Contract W-7405-eng-36)
(DE86-000754; LA-UR-85-3313; CONF-8508127-2) Avail: NTIS HC A02/MF A01

It is argued on theoretical and phenomenological grounds that confinement of quarks is intrinsically a many-body interaction. The Born-Oppenheimer approximation to the bag model is shown to give rise to a static potential energy that consists of a sum of two-body Coulomb terms and a many-body confining term. Following the success of this potential in heavy Q anti Q systems it is being applied to Q(2) anti Q(2). Preliminary calculations suggest that dimeson bound states with exotic flavor, such as bb anti s anti s, exist. DOE

**N86-23427#** Los Alamos National Lab., N. Mex.
**POTENTIAL CAPABILITIES AT LAMPF TO STUDY NUCLEI FAR FROM STABILITY**
W. L. Talbert and M. E. Bunker 1985 7 p refs Presented at the 190th American Chemical Society National Meeting, Chicago, Ill., 8 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000770; LA-UR-85-3234; CONF-850942-27) Avail: NTIS HC A02/MF A01

Feasibility studies have shown that a He-jet activity transport line, with a target chamber placed in the LAMPF main beam line, will provide access to short-lived isotopes of a number of elements that cannot be extracted efficiently for study at any other type of on-line facility. The He-jet technique requires targets thin enough to allow a large fraction of the reaction products to recoil out of the target foils; hence, a very intense incident beam current, such as that uniquely available at LAMPF, is needed to produce yields of individual radioisotopes sufficient for detailed nuclear studies. The results of feasibility experiments on He-jet transport efficiency and timing are presented. Also present estimates on availability of nuclei far from stability from both fission and spallation processes. Areas of interest for study of nuclear properties far from stability are outlined. DOE

**N86-23428#** Los Alamos National Lab., N. Mex.
**MUON NUMBER VIOLATING RARE DECAYS**
M. D. Cooper 1985 3 p refs Presented at the International Europhysics Conference on High Energy Physics, Bari, Italy, 18 Jul. 1985
(Contract W-7405-eng-36)
(DE86-000775; LA-UR-85-3199; CONF-850721-5) Avail: NTIS HC A02/MF A01

The experimental status of rare decays that violate muon number conservation is summarized, giving upper limits of their branching ratios with 90% confidence. All of the muon experiments share several common elements. They aim to identify the process sought through the measurement of kinematical variables. Large solid angles are required to reach very high sensitivities. The need for good resolution stresses technology in high-rate environments to suppress backgrounds. In order to understand the detector response, known processes are measured where possible. A few experiments planned to detect muon number nonconserving processes are briefly described. DOE

**N86-23429#** Los Alamos National Lab., N. Mex.
**ELECTRON-BEAM ENVELOPES AND MATCHING FOR A COMBINED WIGGLER AND ALTERNATING-GRADIENT QUADRUPOLE CHANNEL**
T. F. Wang and R. K. Cooper 1985 14 p Presented at the 6th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000783; LA-UR-85-3164; CONF-850956-2) Avail: NTIS HC A02/MF A01

The electron-beam envelopes and matching for a combined wiggler and alternating-gradient quadrupole field for a free-electron laser (FEL) that will be operated in the VUV or XUV wavelength region are discussed. The quadrupole field is assumed to vary continuously along the symmetry axis. The linearized equations of electron motion are solved analytically by using the two-scale perturbation method for a plane polarized wiggler. The electron-beam envelopes and the envelope equations, as well as the matching conditions in phase space, are obtained from the electron trajectories. A comparison with the numerical solution is presented. DOE

**N86-23430#** Los Alamos National Lab., N. Mex.
**SOURCE-JERK ANALYSIS USING A SEMI-EXPLICIT INVERSE KINETIC TECHNIQUE**
G. D. Spriggs and R. A. Pederson 1985 10 p refs Presented at the DOE Subcritical Reactivity Measurements Workshop, Albuquerque, N. Mex., 26 Aug. 1985
(Contract W-7405-eng-36)
(DE86-000803; LA-UR-85-3416; CONF-8508105-5) Avail: NTIS HC A02/MF A01

A method is proposed for measuring the effective reproduction factor, k, in subcritical systems. The method uses the transient response of a subcritical system to the sudden removal of an extraneous neutron source (i.e., a source jerk). The response is analyzed using an inverse kinetic technique that least-squares fits the exact analytical solution corresponding to a source-jerk transient as derived from the point-reactor model. It has been found that the technique can provide an accurate means of measuring k in systems that are close to critical (i.e., $0.95 < k < 1.0$). As a system becomes more subcritical (i.e., $k << 1.0$) spatial effects can introduce significant biases depending on the source and detector positions. However, methods are available that can correct for these biases and, hence, can allow measuring subcriticality in systems with k as low as 0.5. DOE

**N86-23431#** Carnegie-Mellon Univ., Pittsburgh, Pa.
**EXPERIMENTAL MEDIUM ENERGY PHYSICS ANNUAL PROGRESS REPORT, JUNE 1984-MAY 1985**
1985 127 p
(Contract DE-AC02-76ER-03244)
(DE86-001839; DOE/ER-03244/117) Avail: NTIS HC A07/MF A01

During the past year the principal activities of the CMU Medium Energy Physics Group have included the running of three previously approved experiments, the development of hardware and software for these experiments, and final analysis of previously accumulated data. In a two week run at LEAR at the beginning of this year 100 data tapes were collected on experiment PS-185. This spring sigma hyperon production in Lithium was studied in a run on AGS experiment E-774. We are AGS experiment E-788 is currently being set up in an investigation of Lambda weak decay in Helium hypernuclei. In addition a new experiment to search for strangeness S = -2 dibaryon production was presented and approved by the AGS program advisory committee for 1000 h (E-813). For these experiments extensive hardware and software development has taken place, requiring much of the group's effort. Analysis of LEAR experiment PS-185 is in full progress at CMU. Both the weak decay studies of C-12 (AGS E-759) and the pion annihilation studies in Lithium and Oxygen have now been fully analyzed with the results submitted for publication in several papers. DOE

**N86-23432#** Maryland Univ., College Park.
**HIGH ENERGY ACCELERATOR AND COLLIDING BEAM USER GROUP Progress Report**
Oct. 1985 92 p
(Contract DE-AC05-76ER-02504)
(DE86-001896; DOE/ER-02504-437) Avail: NTIS HC A05/MF A01

The OPAL project at LEP has begun to dominate the research activites at Maryland. A very large new laboratory has been commissioned in the Physics Building. In this laboratory wire chambers and pads are being assembled and tested before shipment to CERN for insertion in the iron magnet calorimeter. Detailed design of most of the calorimeter has been completed, along with a plan for assembly and testing of the barrel calorimeter at CERN. A chamber production facility is being set up at Maryland to supplement the facility at Frascati that has been the source of all the chambers to date. The Frascati operation is carried out by our Bologna collaborators with some Maryland help. Production of part of the forward electromagnetic calorimeter has also begun in collaboration with University College, London. Excellent progress has been made on the problem of simulating the hadron calorimeter's response to multi GeV hadrons. Detailed Monte Carlos using a new OPAL program GEANT3/GHEISHA have been able to fit the Maryland calorimeter prototype test data taken at BNL. DOE

**N86-23433#** Hanford Atomic Products Operation, Richland, Wash. Rockwell Hanford Operations.
**CHEMICAL PROCESSING MONTHLY REPORT, APRIL 1985**
Apr. 1985 40 p
(Contract DE-AC06-77RL-01030)
(DE86-001942; RHO-PB-SR-10-B-CP-1) Avail: NTIS HC A03/MF A01

In the PUREX/UO3 operations, 151 tones of N reactor fuel were charged to the PUREX dissolvers in April 1985, bringing the Fiscal Year-to-Date (FYTD) total to 667, which is now only 61 tones behind the 1200 tone recovery plan. One hundred thirty-nine tonnes of UO3 were shipped to the Feed Materials Production Center (FMPC), bringing the FYTD total to 644 tones. Twenty-two percent of the PUO2 shipments were achieved, bringing the cumulative shipments to 52%. In the plutonium finishing (PF) plant/nuclear materials management program, 10% of plutonium nitrate was loaded out. Total Operating Efficiency for Plutonium Reclamation Facility (PRF) was 53% for the month, compared to a goal of 70%. Remote Mechanical C (RMC) metal line reactivation activities are 95% complete. Terminal clean out operations are about one month behind schedule, due to diversion of personnel to the RMC reactivation effort. Within the area of decontamination and decommissioning activities, removal of the Sorter/Chopper hood in 232-Z Building was completed. Design on B-339, vault safety and inventory system was completed on schedule. DOE

**N86-22738#** Joint Publications Research Service, Arlington, Va.
**APPLICATIONS OF HIRFL HEAVY ION ACCELERATOR SURVEYED**
Guohua Wu *In its* China Report: Science and Technology (JPRS-CST-86-004) 28 Jan. 1986 p 51-58 Transl. into ENGLISH from Wuli Tongbao (Baoding, China), no. 4, 10 Aug. 1985 p 23-28
(For primary document see N86-22735 13-31)
Avail: NTIS HC A06/MF A01

# 74 OPTICS

Includes light phenomena.

**N86-23434** New Mexico Univ., Albuquerque.
**NUMERICAL MEASUREMENTS OF WAVEFRONT ABERRATION Ph.D. Thesis**
Christopher Roy DeHainaut 1985 182 p
Avail: Univ. Microfilms Order No. DA8518560

The estimation of wavefront aberrations is central to both optical testing and real time control of active optical systems. Optical measurements, whether wavefront tilts, optical path difference, or image plane intensitites, must be numerically transformed into meaningful aberrations. Accurate and more noise tolerant algorithms were developed to process these measurements. A number of generic estimation techniques are presented which are suitable for processing measurements taken at a single point in time. All of these static processing techniques prove to be variations on the Bayesian minimum variance estimator. Reviews of a point spread function measurement processor and a Hartman sensor processor serve as an introduction to practical aberration measurement processing. Two approaches to testing afocal telescopes with an array of small flats instead of the usual single large flat, called subaperture testing, are analyzed in detail. The static aberration measurement theory is then extended to accommodate sequences of measurements taken over a number of points in time. Dissert. Abstr.

**N86-23435#** Defence Research Information Centre, Orpington (England).
**A SCATTERED-LIGHT COUNTING TECHNIQUE FOR DETERMINING CAVITATION-NUCLEI SPECTRA**
A. Keller Sep. 1985 21 p refs Transl. into ENGLISH from Optik, vol. 32, no. 2, 1970 p 165-176
(DRIC-T-7593; BR97247) HC A02/MF A01

A technique for recording the spectra of free-bubble cavitation nuclei was developed. Results obtained from research on aerosols were used as the basis of the technique, which exploits the optical properties of the nuclei. The theoretical principles are discussed, as are experimental results obtained by the scattered-light counter. Results show that the device enables the spectrum of cavitation nuclei in water to be recorded quickly, without any disturbance. Author (ESA)

**N86-23436*#** Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
**A LABORATORY INVESTIGATION OF THE VARIABILITY OF CLOUD REFLECTED RADIANCE FIELDS Final Technical Report**
Thomas B. McKee and Stephen K. Cox [1986] 72 p refs
(Grant NAG5-387)
(NASA-CR-176612; NAS 1.26:176612) Avail: NTIS HC A04/MF A01 CSCL 20F

A method to determine the radiative properties of complex cloud fields was developed. A Cloud field optical simulator (CFOS) was constructed to simulate the interaction of cloud fields with visible radiation. The CFOS was verified by comparing experimental results from it with calculations performed with a Monte Carlo radiative transfer model. A software library was developed to process, reduce, and display CFOS data. The CFSOS was utilized to study the reflected radiane patterns from simulated cloud fields. B.G.

**N86-23437#** Department of the Air Force, Washington, D.C.
**MODULATED OPTICAL ENERGY SOURCE Patent Application**
Kenneth R. Matosian, inventor (to Air Force) Filed 16 Oct. 1985 25 p
(AD-D012012; US-Patent-Appl-SN-788188) Avail: NTIS HC A02/MF A01 CSCL 17/8

This patent application discloses an optical radiant energy source capable of far infrared spectrum operation and on-off energy modulation without interruption of the radiation sources operating temperature characteristics. Provisions for radiant energy dissipation as part of the modulation, for achieving uniform output beam dispersion over a specified area, and for airframe mounting of the disclosed apparatus are also included. GRA

**N86-23438#** Lawrence Livermore National Lab., Calif.
**MEASURING NUMERICAL APERTURE AND ILLUMINATION DISTRIBUTION OF AN OPTICAL FIBER: AN INSTRUMENT AND A METHOD**
F. A. Schumacher and R. P. Reedy 30 Sep. 1985 9 p
(Contract W-7405-eng-48)
(DE86-002844; UCRL-53664) Avail: NTIS HC A02/MF A01

A simple instrument to quickly and easily record the far-field or near-field pattern produced by an optical fiber was designed, constructed, and tested. The instrument can be used for quality assurance testing of terminated optical fibers. This instrument can also be used to experimentally characterize a large variety of terminated or unterminated optical fibers; to study the effects that mode stripping, mode scrambling, micro bending, wavelength, and launch conditions have on the illumination distribution coming from the fiber; to look for anomalies in the illumination distribution caused by a defective index profile or termination problem. DOE

**N86-23439#** Lawrence Livermore National Lab., Calif.
**HIGH BRIGHTNESS TEST STAND**
D. L. Birx, G. J. Caporaso, J. K. Boyd, S. A. Hawkins, S. E. Poor, L. L. Reginato, D. Rogers, Jr., and M. W. Smith Aug. 1985 13 p Presented at the 7th International Free-Electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract W-7405-eng-48)
(DE86-002372; UCRL-93174; CONF-850956-7) Avail: NTIS HC A02/MF A01

The High Brightness Test Stand is a 2 MeV, less than or equal to 10 kA electron accelerator module. This accelerator module, designed as an upgrade prototype for the Advanced Test Accelerator (ATA), combines solid state nonlinear magnetic drives with state-of-the-art induction linac technology. The facility serves a dual role, as it not only provides a test bed for this new technology, but is used to develop high brightness electron optics. We will both further describe the accelerator, as well as present some of the preliminary electron optics measurements. DOE

**N86-22773#** Joint Publications Research Service, Arlington, Va.
**TRENDS IN DEVELOPMENT OF ELECTRON OPTICS**
Jiye Ximen *In its* China Report: Science and Technology (JPRS-CST-86-010) 19 Mar. 1986 p 117-128 refs Transl. into ENGLISH from Dianzi Xuebao (Beijing, China), v. 12, no. 2, Mar. 1984 p 90-96 (For primary document see N86-22767 13-31)
Avail: NTIS HC A08/MF A01

**N86-22794*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**PHYSICAL OPTICS ANALYSIS OF A FOUR-REFLECTOR ANTENNA, PART 1**
A. G. Cha *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 94-100 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 20F

# 75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**N86-23440#** Iowa State Univ. of Science and Technology, Ames.
**INVESTIGATION OF HADRONIC MATTER AT THE FERMILAB TEVATRON COLLIDER Technical Progress Report**
E. W. Anderson 22 Oct. 1985 12 p refs
(Contract DE-AC02-85ER-40193)
(DE86-001877; DOE/ER-40193/T1) Avail: NTIS HC A02/MF A01

Hadronic matter at very high energy densities is investigated.

The present experimental effort is focused on a search for a new quark-gluon plasma phase expected to occur when temperatures of 240 MeV are achieved. Instrumentation for several unique signatures is being developed to exploit the first operation of the Fermilab Tevatron Collider in 1986. The capital projects funded under this contract are a 240-element trigger hodoscope array, and a segmented photon detector. For these projects $172K are requested for the period 1986 February 1 through 1987 January 31 to complete the trigger hodoscope, and $160K for the period 1987 February 1 through 1988 January 31 to construct a portion of the photon detector. These figures are as presented in the original proposal. Due to budget constraints on the Fermilab experimental support program, we will not be able to receive the full complement of necessary electronics from the Fermilab PREP pool in the required period. Consequently, an additional $35K is requested for the period 1986 February 1 through 1987 January 31 for a portion of the electronics for the 240-channel trigger hodoscope. For the same reasons, Fermilab cannot provide the required magnet on schedule; a one year delay is proposed. As this would seriously impact our physics goals, the collaboration is attempting to fund the magnet without delay through the universities. Efforts to date have concentrated on the design and testing of the hodoscope. Extensive measurements on the radiation levels and effects during the various accelerator cycles have been made. These data are essential to the proper selection of scintillator and design of electronics. These tests are now complete, and final construction is beginning. DOE

**N86-23441#** Texas Univ., Austin. Inst. for Fusion Studies.
**SELF-CONSISTENCY CONSTRAINTS ON TURBULENT MAGNETIC TRANSPORT AND RELAXATION IN COLLISIONLESS PLASMA**
P. W. Terry, P. H. Diamond, and T. S. Hahm Oct. 1985 10 p
(Contract DE-FG05-80ET-53088)
(DE86-002074; DOE/ET-53088/203; IFSR-203) Avail: NTIS HC A02/MF A01

Novel constraints on collisionless relaxation and transport in drift-Alfven turbulence are reported. These constraints arise due to the consideration of mode coupling and incoherent fluctuations and the proper application of self-consistency conditions. The result that electrostatic fluctuations alone regulate transport in drift-Alfven turbulence follows directly. Quasilinear transport predictions are discussed in light of these constraints. DOE

**N86-23442#** Lawrence Livermore National Lab., Calif.
**VACUUM SYSTEM FOR HYPERVELOCITY RAILGUN EXPERIMENTS**
A. R. Susoeff 12 Sep. 1985 9 p
(Contract W-7405-eng-48)
(DE86-002293; UCID-20564) Avail: NTIS HC A02/MF A01

In order for railguns to achieve very high velocities it will be necessary to operate at reduced atmospheric pressure, perhaps even high vacuum. Use of railguns in a space environment will also be facilitated by successful vacuum operation. Equation of state research requires projectile impact on target prior to a bow shock wave necessitating high vacuum environment. The H Division/LLNL Railgun Project achieved successful high vacuum operation. A modular, free-standing vacuum system was designed, fabricated and characterized to conduct experiments with single and multi-staged hypervelocity railguns. Operating environment for the experiments was in the low 10 to the -6 power torr pressure range, equivalent to the atmosphere at about 75/100 miles altitude. The first successful high vacuum region (i.e., low pressure side of the Paschen voltage breakdown curve) railgun experiments were performed with this apparatus. The vacuum system and its operating characteristics are described DOE

**N86-23443#** Oak Ridge National Lab., Tenn.
**CALIBRATION OF THE ORNL TWO-DIMENSIONAL THOMSON SCATTERING SYSTEM**
C. E. Thomas, Jr., E. A. Lazarus, R. R. Kindsfather, M. Murakami, and K. A. Stewart Oct. 1985 71 p
(Contract DE-AC05-84OR-21400)
(DE86-002556; ORNL/TM-9507) Avail: NTIS HC A04/MF A01

A unified presentation of the calibrations needed for accurate calculation of electron temperature and density from Thomson scattering data for the Oak Ridge National Laboratory two-dimensional Thomson scattering system (SCATPAK II) is made. Techniques are described for measuring the range of wavelengths to which each channel is responsive. A statistical method for calibrating the gain of each channel in the system is given, and methods of checking for internal consistency and accuracy are presented. The relationship between the constants describing the relative light collection efficiency of each channel and plasma light-scattering theory is developed, methods for measuring the channel efficiencies and evaluating their accuracy are described, and the effect on these constants of bending fiber optics is discussed. The use of Rayleigh or Raman scattering for absolute efficiency (density) calibration, stray light measurement, and system efficiency evaluation is discussed; the relative merits of Rayleigh vs Raman scattering are presented; and the relationship among the Rayleigh/Raman calibrations, relative channel efficiency constants, and absolute efficiencies is developed. DOE

**N86-23444#** Department of Energy, Washington, D. C.
**COMPUTING FOR PARTICLE PHYSICS. REPORT OF THE HEPAP SUBPANEL ON COMPUTER NEEDS FOR THE NEXT DECADE**
Aug. 1985 166 p
(DE86-002045; DOE/ER-0234) Avail: NTIS HC A08/MF A01

The increasing importance of computation to the future progress in high energy physics is documented. Experimental computing demands are analyzed for the near future (four to ten years). The computer industry's plans for the near term and long term are surveyed as they relate to the solution of high energy physics computing problems. This survey includes large processors and the future role of alternatives to commercial mainframes. The needs for low speed and high speed networking are assessed, and the need for an integrated network for high energy physics is evaluated. Software requirements are analyzed. The role to be played by multiple processor systems is examined. The computing needs associated with elementary particle theory are briefly summarized. Computing needs associated with the Superconducting Super Collider are analyzed. Recommendations are offered for expanding computing capabilities in high energy physics and for networking between the laboratories. DOE

**N86-23445#** GA Technologies, Inc., San Diego, Calif.
**BIG DEE: A FLEXIBLE FACILITY OPERATING NEAR BREAK-EVEN CONDITIONS**
J. L. Luxon and L. G. Davis Mar. 1985 13 p Presented at the 6th Topical Meeting on the Technology of Fusion Energy, San Francisco, Calif., 3 Mar. 1985
(Contract DE-AC03-84ER-51044)
(DE86-001763; GA-A-17899; CONF-850310-118) Avail: NTIS HC A02/MF A01

The Doublet III tokamak facility is presently undergoing an upgrade to Big Dee, a device projected to be capable of producing plasmas with parameters approaching breakeven conditions, albeit in hydrogen plasmas. The goal of the upgrade has been to develop a facility capable of studying confinement and beta in non-circular discharges at parameters near breakeven conditions while maintaining the flexibility and accessibility necessary to allow a wide range of problems to be addressed. The upgrade replaces the vacuum vessel and outermost plasma shaping coils allowing higher plasma currents and improved access. DOE

**N86-23446#** Department of Energy, Washington, D. C.
**FUSION CONNECTION: CONTRIBUTIONS TO INDUSTRY, DEFENSE AND BASIC SCIENCE RESULTING FROM SCIENTIFIC ADVANCES MADE IN THE MAGNETIC FUSION ENERGY PROGRAM**
T. Finn, J. Woo, R. Temkin, D. Anderson, J. Anderson, D. Barbosa, R. Briggs, J. Callen, S. Colgate, and J. Cowles Oct. 1985 33 p
(DE86-001774; DOE/ER-0250) Avail: NTIS HC A03/MF A01

Fusion research has led to significant contributions in many

different areas of industry, defense, and basic science. This diversity is represented visually in the introductory figure which shows both a radio galaxy, and a microchip produced by plasma etching. Some of these spin-off technologies are discussed. DOE

**N86-23447#** Avco-Everett Research Lab., Mass.
**MHD CHANNEL DEVELOPMENT Quarterly Report, Jan. - Mar. 1985**
May 1985 156 p refs
(Contract DE-AC22-84PC-70507)
(DE86-002520; DOE/PC-70507/4) Avail: NTIS HC A08/MF A01

The cathode wall nonuniformity modeling was completed. Good agreement was obtained between the results of the model and experimental data. Secondary flow investigations were continued, with the use of channel heat flux data as an indicator. Work continued on the possible use of ceramic wall elements in the insulating walls adjacent to the cathode, paricularly in the regions where high voltage spikes exist. A summary of the evolution design, and testing of the CDIF power conditioning circuits is presented. The Mk VI and Mk VII facilities were operated for a total of 74 1/2 hours during this reporting period. Power was generated for 20 hours. DOE

**N86-23448#** Argonne National Lab., Ill.
**OVERVIEW OF THE CHARACTERISTICS OF THE 6-GeV SYNCHROTRON RADIATION: A PRELIMINARY GUIDE FOR USERS**
G. K. Shenoy and P. J. Viccaro Oct. 1985 72 p refs
(Contract W-31-109-eng-38)
(DE86-002540; ANL-85-69) Avail: NTIS HC A04/MF A01

In this document we present the characteristics of the electromagnetic radiation from various types of sources on a 6-GeV storage ring. The sources include bending magnets, undulators and wigglers. The characteristics are compared with those of other synchrotron sources when operated at their design specifications. The influence of positron beam size on the brilliance is discussed, along with the power distribution from these sources. The goal of this document is to provide users with enough information on the behavior of radiation from a 6-GeV storage ring so that a dialogue can be established with the accelerator physicists and engineers to acheive an optimal design. DOE

**N86-23449#** Washington Univ., Seattle.
**RAMAN SCATTERING AND ASSOCIATED FAST ELECTRON PRODUCTION Final Technical Report, 16 Apr. 1984 - 15 Apr. 1985**
R. D. Brooks and Z. A. Pietrzyk Aug. 1985 33 p
(Contract W-7405-eng-48)
(DE86-002623; UCRL-15722) Avail: NTIS HC A03/MF A01

High energy electrons in plasmas have been attributed to various causes including trapping by electron plasma waves created by stimulated Raman scattering. A theory, consistent with experimental results, based on the acceleration of trapped electrons by such electron plasma waves as they propagate in the presence of a density gradient away from the region where they are created is presented. Single particle simulations show accelerating voltages as high as 20 GV/m. DOE

**N86-23450#** Texas Univ., Austin. Inst. for Fusion Studies.
**HEALING OF MAGNETIC STOCHASTICITY AND ISLANDS BY SELF-CONSISTENT PLASMA CURRENTS**
M. Kotschenreuther Oct. 1985 14 p
(Contract DE-FG05-80ET-53088)
(DE86-002640; DOE/ET-53088/211; IFSR-211) Avail: NTIS HC A02/MF A01

When resonant magnetic perturbations are imposed on a toroidally confined plasma, magnetic stochasticity can arise. It is shown that the transport of electrons in the stochasticity can lead to self-consistent magnetic fields which can greatly reduce, or heal, the stochasticity in steady state. These currents occur if there is another plasma transport process operating in which the radial fluxes of electrons and ions are not automatically equal. The healing effect can be quite strong in stellarator plasma confinement devices for fusion applications. DOE

**N86-23451#** Lawrence Livermore National Lab., Calif.
**THERMAL STRESS ANALYSIS OF THE SLAC MOVEABLE MASK, ADDENDUM 2**
G. L. Johnson 15 Oct. 1985 33 p
(Contract W-7405-eng-48)
(DE86-002958; UCID-20498-Add-2) Avail: NTIS HC A03/MF A01

X-ray beams emerging from the new SLAC electron-positron storage ring (PEP) can impinge on the walls of tangential divertor channels. A moveable mask made of 6061-T6 aluminum is installed in the channel to limit wall heating. The mask is cooled with water flowing axially at 30C. Beam strikes on the mask cause highly localized heating in the channel structure. Analyses were completed to determine the temperatures and thermally-induced stresses due to this heating. The current design and operating conditions should result in the entrance to the moveable mask operating at a peak temperature of 88C with a peak thermal stress at 19% of the yield of 6061-T6 aluminum. DOE

**N86-23452#** Oak Ridge National Lab., Tenn.
**IFSMTF POWER SUPPLY REGULATOR**
J. M. Googe, L. E. Nickels, R. E. Wintenberg, and R. J. Wood 1985 4 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985 Prepared in cooperation with Tennessee Univ., Knoxville and Nickels Engineering, Inc., New Berlin, Wis.
(Contract DE-AC05-84OR-21400)
(DE86-003009; CONF-851102-6) Avail: NTIS HC A02/MF A01

The high-current, low voltage power supplies for the International Fusion Superconducting Magnet Test Facility at Oak Ridge National Laboratory has been redesigned to eliminate stability problems caused by limiting action and related system dynamics. This paper describes the redesign, simulation, and testing of the power supply regulator for a 2-H, 15,000-A superconducting coil. Included in the paper are circuit models, frequency domain block diagrams, and CSMP simulations of the regulator. The regulator consists of an inner voltage loop and an outer current loop and is provided with adjustable voltage and current limits. The simulation includes a nonlinear function to characterize the gate drive and rectifier units of the power supply. Experimental data demonstrating the performance of the regulator are included for comparisons with the simulation. DOE

**N86-23453#** Oak Ridge National Lab., Tenn.
**ATFSR: A SMALL TORSATRON REACTOR**
W. A. Houlberg, J. T. Lacatski, and N. A. Uckan 1985 5 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-003010; CONF-851102-8) Avail: NTIS HC A02/MF A01

A small (average minor radius anti a approx. = 1 m), moderate-aspect-ratio torsatron reactor based on the Advanced Toroidal Facility (ATF) is proposed as a starting point for improved stellarator reactor designs. The major limitation of the compact size is the lack of space under the helical coils for the blanket and shield. Neoclassical confinement models for helically trapped particles show that a large electric potential (radial electric field) is necessary to achieve ignition in a device of this size, although high-Q operation is still attainable with more modest potentials. DOE

**N86-23454#** Oak Ridge National Lab., Tenn.
**ATF NEUTRAL BEAM INJECTION SYSTEM**
M. M. Menon, R. N. Morris, and P. H. Edmonds 1985 5 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-003012; CONF-851102-7) Avail: NTIS HC A02/MF A01

The Advanced Toroidal Facility is a stellarator torsatron being built at Oak Ridge National Laboratory to investigate improved plasma confinement schemes. Plasmas heating will be carried out

predominantly by means of neutral beam injection. This paper describes the basic parameters of the injection system. Numerical calculations were done to optimize the aiming of the injectors. The results of these calculations and their implications on the neutral power to the machine are elaborated. The effects of improving the beam optics and altering the focal length on the power transmitted to the plasma are discussed. DOE

**N86-23455#** Oak Ridge National Lab., Tenn.
**PROBLEMS AND SOLUTIONS OF THE IFSMTF POWER AND SWITCH SYSTEM**
R. J. Wood, R. E. Wintenberg, J. M. Googe, and L. E. Nickels 1985 5 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985 Prepared in cooperation with Tennessee Univ., Knoxville.; Nickels Engineering, Inc., New Berlin, Wis.
(Contract DE-AC05-84OR-21400)
(DE86-003015; CONF-851102-4) Avail: NTIS HC A02/MF A01

Solutions have been found for the problems encountered with the coil power and switching systems of the International Fusion Superconducting Magnet Test Facility (IFSMTF). The coil power system provides the filtered dc sources (+- 12 V dc; 25,000 A) for charging and discharging the coils of the IFSMTF experiment. The switching system provides the means of transferring the coil current into a dump resistor when a rapid discharge of a coil is required due to a coil failure (quench) or other system abnormalities. DOE

**N86-23456#** Princeton Univ., N. J. Plasma Physics Lab.
**VARIETIES OF SAWTOOTH BEHAVIOR IN TFTR PLASMAS**
V. K. Pare, K. McGuire, R. J. Colchin, P. C. Efthimion, E. Fredrickson, K. W. Hill, G. Taylor, and N. R. Sauthoff 1985 8 p Presented at the Course and Workshop on Basic Physical Processes in Fusion Plasmas, Varenna, Italy, 26 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002219; CONF-850806-3) Avail: NTIS HC A02/MF A01

The side-viewing soft-X-ray camera on the Tokamak Fusion Test Reactor (TFTR) has made possible the observation of several different forms of sawtooth oscillation, which can be categorized according to their position in the plasma, sequence of occurrence, and patterns of associated MHD oscillation. Some insight into the plasma conditions involved can be gained by examining the waveforms in detail, along with electron temperature profiles from electron cyclotron emission measurements. DOE

**N86-23457#** TRW, Inc., Redondo Beach, Calif.
**ION CYCLOTRON RESONANCE HEATING (ICRH) START-UP ANTENNA FOR THE MIRROR FUSION TEST FACILITY (MFTF-B)**
T. M. McCarville and T. E. Romesser 2 Oct. 1985 6 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract W-7405-eng-48)
(DE86-002376; UCRL-92623; CONF-851102-2) Avail: NTIS HC A02/MF A01

The purpose of the ICRH start-up antenna on MFTF-B is to heat the plasma and control the ion distribution as the density increases during start-up. The antenna, consisting of two center fed half turn loops phased 180(0) apart, has been designed for 1 MW of input power, with a goal of coupling 400 kW into the ions. To vary the heating frequency relative to the local ion cyclotron frequency, the antenna is tunable over a range from 7.5 to 12.5 MHz. The thermal requirements common to low duty cycle ICRH antennas are especially severe for the MFTF-B antenna. The stress requirements are also unique, deriving from the possibility of seismic activity or JxB forces if the magnets unexpectedly quench. Considerable attention has been paid to contact control at high current bolt-up joints, and arranging geometries so as to minimize the possibility of voltage breakdown. DOE

**N86-23458#** Los Alamos National Lab., N. Mex.
**FRX-C LARGE SOURCE MODIFICATION**
R. E. Chrien, M. Tuszewski, E. J. Yavornik, G. A. Barnes, W. T. Armstrong, W. N. Hugrass, P. L. Klingner, K. F. McKenna, S. Okada, and D. J. Rej 1985 5 p Presented at the 7th US-Japan Workshop on Compact Toroids, Bellevue, Wash., 12 Nov. 1985
(Contract W-7405-eng-36)
(DE86-002428; LA-UR-85-3850; CONF-8511118-1) Avail: NTIS HC A02/MF A01

The FRX-C Large Source Modification (LSM) consists of a larger discharge tube and a larger radius coil connected to the existing FRX-C collector plates and capacitor banks. The objectives of LSM are to: (1) study the size dependences of processes governing FRC formation and poloidal flux trapping in order to improve the design of larger field-reversed theta pinch devices, (2) increase the parameter s (number of local ion gyroradii between the field null and separatrix) to seek access to predicted new regimes of improved confinement and possible instability, (3) search for evidence of internal tilt instability at higher values of s where the mode is predicted to grow more rapidly, and (4) observe the effect of s and larger size on FRC confinement. In this paper we will discuss the construction of LSM, the experimental plan, and preliminary experimental results. DOE

**N86-23459#** Bechtel Corp., San Francisco, Calif.
**LIQUID HELIUM DUMP CONCEPT FOR A LARGE SCALE SUPERCONDUCTING MAGNETIC ENERGY STORAGE PLANT**
S. M. Schoenung, R. J. Loyd, T. Nakamura, J. D. Rogers, and J. R. Purcell 1985 9 p Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985 Prepared in cooperation with Los Alamos National Lab., New Mex., GA Technologies, Inc., San Diego, Calif.
(Contract W-7405-eng-36)
(DE86-000776; LA-UR-85-3196; CONF-850814-23) Avail: NTIS HC A02/MF A01

Superconducting Magnetic Energy Storage (SMES) is a potentially cost effective technology for electric utility load leveling. Design concepts and cost estimates of SMES plants capable of delivering 5000 MWh daily have been previously identified. An important feature of a large commercial plant is a system that will reliably shut down the magnet by thermally dissipating the stored energy in the event of an imminent or actual loss of superconductivity. To prevent damage to the coil during such a protective energy dump, the entire coil must be driven normal, i.e., resistive rather than superconducting, in a short period of time. This requires rapid removal of the liquid helium coolant surrounding the coil. A simple system that has been developed to rapidly remove the liquid helium from the helium vessel is described. The system requires only a small number of active components, no external helium storage, and is practical to reset and maintain. DOE

**N86-23460#** Bechtel Corp., San Francisco, Calif.
**DESIGN AND COST OF A UTILITY SCALE SUPERCONDUCTING MAGNETIC ENERGY STORAGE PLANT**
R. J. Loyd, T. Nakamura, S. M. Schoenung, D. W. Lieurance, M. A. Hilal, J. D. Rogers, J. R. Purcell, and W. V. Hassenzahl 1985 9 p Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985 Prepared in cooperation with General Dynamics Corp., San Diego, Calif., Los Alamos National Lab., N. Mex., GA Technologies, Inc., San Diego, Calif., California Univ., Lawrence Berkeley Lab.
(Contract W-7405-eng-36)
(DE86-000777; LA-UR-85-3195; CONF-850814-26) Avail: NTIS HC A02/MF A01

Superconducting Magnetic Energy Storage (SMES) has potential as a viable technology for use in electric utility load leveling. The advantage of SMES over other energy storage technologies is its high net roundtrip energy efficiency. The major features and costs of a jointly developed 5000 MWh SMES plant design are described. DOE

**N86-23461#** Florida State Univ., Tallahassee. Dept. of Physics.
**RESEARCH IN THEORETICAL NUCLEAR PHYSICS Progress**

**Report**
D. Robson 1985 8 p refs
(Contract DE-AS05-79ER-10419)
(DE86-001955; DOE/ER-10419/4) Avail: NTIS HC A02/MF A01

A summary of results and findings for the past three years is reported. The goal of the work is to derive a successful theory for nuclear physics, and in this effort models are used which are based on a lattice gauge approach to Quantum Chromodynamics. Major results are presented for work in areas of relativistic wave equations, nucleon-nucleon systems, charmonium and upsilonium, and relativistic quark models with chiral symmetry. Future work and collaborations are discussed. DOE

**N86-22746#** Joint Publications Research Service, Arlington, Va.
**PROGRESS IN PLASMA FOCUS RESEARCH**
Jinji Yang and Min Han *In its* China Report: Science and Technology (JPRS-CST-86-006) 13 Feb. 1986 p 39-51 refs Transl. into ENGLISH from He Kexue Yu Gongcheng (Beijing, China), v. 5, no. 2, Jun. 1985 p 165-173 (For primary document see N86-22741 13-31)
Avail: NTIS HC A04/MF A01

**N86-23524*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE ELECTROSTATICS OF A DUSTY PLASMA**
E. C. Whipple (California Univ., San Diego), D. A. Mendis (California Univ., San Diego), and T. G. Northrop *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

# 76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

**N86-23462** Stanford Univ., Calif.
**A HIGH TRANSITION TEMPERATURE SUPERCONDUCTING INTEGRATED CIRCUIT Ph.D. Thesis**
Mark Steven Dilorio 1985 357 p
Avail: Univ. Microfilms Order No. DA8522129

The design and fabrication of the first superconducting integrated circuit capable of operating at over 10K. The primary component of the circuit is a dc Superconducting Quantum Interference Device (SQUID) which is extremely sensitive to magnetic fields. The dc SQUID consists of two superconductor-normal metal-superconductor (sNS) Josephson microbridges which are fabricated using a step edge process which permits the use of high transition temperature superconductors. By utilizing electron bean lithography in conjunction with ion beam etching, very small microbridges can be produced. Such microbridges lead to high performance dc SQUIDs with products of the critical current and normal resistance reaching mV at 4.2 K. These SQUIDs were extensively characterized, and exhibit excellent electrical characteristics over a wide temperature range. The completed circuits operated successfully over a wide temperature range, from 4.2 K to 14 K. Limitations were encountered in the form of an excess inductance. The origins of such an inductance have important and wide ranging ramifications for superconducting devices employing the high transition temperature materials. Dissert. Abstr.

**N86-23463** Stevens Inst. of Tech., Hoboken, N. J.
**A SURFACE STUDY OF MERCURY-CADMIUM-TELLURIDE Ph.D. Thesis**
Vincent C. Lopes 1985 178 p
Avail: Univ. Microfilms Order No. DA8522795

Single crystals of Hg (sub 1-x) Cd (sub x) Te were studied to determine how changes in the surface conditions affected electrical properties, infrared detector grade material was used to examine the effects of changes in the surface charge density on electrical I/f noise. The surface charge density which was controlled by the pH of the aqueous solution was measured in a zeta meter which operated much like a Millikan oil drop experiment. The electrophoresis zeta potential measurements on (HgCd)Te have identified the active surface oxide as TeO2 and has also revealed information on the surface chemistry. Electrical I/f noise in-(HgCd)Te was found to be dominated by bulk and not surface effects at room temperature. Laser Raman and Auger spectroscopy were used to assess mechanical surface damage and anodic oxide composition. Dissert. Abstr.

**N86-23464** Stanford Univ., Calif.
**METAL AND OXYGEN INTERACTIONS WITH 3-5 COMPOUND SEMICONDUCTOR SURFACES Ph.D. Thesis**
William George Petro 1985 250 p
Avail: Univ. Microfilms Order No. DA852213

Soft X-ray photoemission spectroscopy of the metal and semiconductor core levels, valence bands, and PL sub 2,3 VV Auger transitions were used to study the interactions of metals and oxygen with the cleaved GaAs(110) and InP(110) surfaces. The specific systems studied in detail are Au/GaAs, Au/InP, Ag/InP, Cu/InP, Tl/GaAs and oxygen/GaAs. It is found that the interactions observed for the noble metals can in some cases deviate from the predictions of simple bulk thermodynamic calculations. These surface related interactions are found to be distinct for each noble metal. The reactions are important in determining Schottky barrier heights. Results can be explained in terms of defect-formation model and are compared to theoretical calculations of the energy positions of native defects levels in the gap. The effect of low-intensity laser radiation during the oxidation of the GaAs(110) surface was studied using photoemission spectroscopy of the Ga 3d and As 3d core levels. Dissert. Abstr.

**N86-23465#** North Carolina State Univ., Raleigh.
**AMORPHOUS HYDROGENATED SILICON-GERMANIUM ALLOY THIN FILMS Ph.D. Thesis**
Ronald Alan Rudder 1985 140 p
Avail: Univ. Microfilms Order No. DA8518299

There were many problems associated with the deposition of amorphous hydrogenated silicon-germanium alloys (a.Si sub 1-x Ge sub x: H) that have good photoelectronic properties. Previous studies have shown that the addition of germanium creates defect states that could not be adequately compensated with hydrogen. To address these problems a dual magnetron sputtering system was designed and constructed which produces alloys that have improved photoconductivity over what was previously reported. The improved quality of these alloys was corroborated by subband gap absorption measurements which reveal that the electronic density of states at mid-gap is only about a factor of seven higher than in photovoltaic grade amorphous hydrogenated silicon. Correspondingly, infrared studies on these alloys have revealed that the germanium sites remain well hydrogenated. A model for the deposition process was proposed. This model had to account for the critical role that the germanium atoms were playing in the alloys to suppress the formation of polymerized silicon dihydride groups at the low substrate temperatures and high hydrogen partial pressures where polymerized silicon dihydride formation would occur in amorphous hydrogenated silicon films. Dissert. Abstr.

**N86-23466** Stanford Univ., Calif.
**PART 1: NONLINEAR ANALYSIS OF THREE COUPLED JOSEPHSON JUNCTIONS. PART 2: GENERAL BOND-TO-SITE MAPPING IN AGGREGATION Ph.D. Thesis**
Philip Neil Strenski 1985 97 p
Avail: Univ. Microfilms Order No. DA8522232

A small array of Josephson junctions, superconducting devices of markedly, nonlinear behavior were analyzed. The components of the array are modelled as resistively-shunted junctions and are driven by direct currents. The validity and features of such a model for the case of a single junction are revealed, and background information on the subjects of bifurcation, chaos, and fractals is included. The array of three junctions is studied, first with one driving current and later with an additional bias current. The analysis

includes both numerical results from computer simulations and analytic computations using a perturbative approach. The two approaches are shown to be in good agreement. The behavior of the array is dominated by hysteresis effects. With a single driving current, four branches are seen in the current-voltage characteristics. The functional dependences of these curves, as well as the hysteretic cutoffs, are calculated. Small regions of bifurcations and chaotic behavior are also seen and examined. Dissert. Abstr.

**N86-23467** Department of the Air Force, Washington, D.C.
**INP:TE PROTECTIVE LAYER PROCESS FOR REDUCING SUBSTRATE DISSOCIATION Patent**
Frank Z. Hawrylo, inventor (to Air Force) Issued 10 Sep. 1985 4 p
(AD-D011987; US-Patent-4,540,450; US-Patent-Appl-SN-661646; US-Patent-Class-148-171) Avail: US Patent and Trademark Office CSCL 20/12

In order to prevent the formation of indium droplets upon the surface of an indium phosphide wafer during liquid phase epitaxial growth, a doped protective layer is deposited by LPE upon said substrate before epitaxial growth of additional layers occurs. The doped protective layer is composed of indium phosphide doped with tellurium to a concentration of about high 10 to the 18th power to low 10 to the 19th power. This invention relates to the fabrication of semiconductor devices, and, more particularly, to the deposition of an epitaxial layer on the surface of an indium phosphide substrate. GRA

**N86-23468*#** Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.
**OPTICAL CONSTANTS OF GaAs-AlGaAs SUPERLATTICES AND MULTIPLE QUANTUM WELLS**
K. B. Kahen and J. P. Leburton [1986] 24 p refs
(Grant NAG3-507)
(NASA-CR-176717; NAS 1.26:176717) Avail: NTIS HC A02/MF A01 CSCL 20L

The optical properties of GaAs-Al sub x Ga sub 1-xAs superlattices are calculated as a function of the frequency and superlattice structure. The comutations are performed using a partition method which combines the vectors k.p method with the pseudopotential technique. The influence of the super-structure on the electronic properties of the systems is accounted for by appropriate quantization conditions. The anisotropy and structure dependence of the dielectric constant result mainly from the contribution of the gamma region while the contributions of the other regions of the Brillouin zone are rather insensitive to the superlattice structure. The superlattice index of refraction values are shown to attain maxima at the various quantized transition energies, where for certain structures, the difference between the refractive indices of the superlattices and its corresponding Al sub x Ga sub 1-xAs alloy can be as large as 2%. In general results are in good agreement with the experimental data. Author

**N86-23469#** IBM Research Lab., Yorktown Heights, N. Y.
**RESONANCE RAMAN SCATTERING AND FAST TIME-RESOLVED SPECTROSCOPY OF IMPURITY LEVELS IN 3-5 SEMICONDUCTOR ALLOYS Final Report, 1 Mar. 1980 - 14 Nov. 1984**
Donald J. Wolford 1 Aug. 1985 254 p
(Contract N00014-80-C-0376)
(AD-A162482; Rept-51028) Avail: NTIS HC A12/MF A01 CSCL 07/4

We have performed experimental and theoretical studies of the electronic, vibrational, and kinetic properties of electronic bound states in 3-5, and silicon- and germanium-based semiconducting materials. This has included new CVD growth of crystals and thin-films and an advanced program of high-pressure (diamond anvil cell) techniques. Electronic states investigated have included intrinsic and defect-induced levels lying near or within the gap of the host materials. Experiments have involved: (1) photoluminescence (PL); (2) PL-excitation (PLE); (3) visible - and infrared-absorption; (4) resonant PL and Raman scattering; and (5) subnanosecond time-resolved luminescence performed at a variety of temperatures and hydrostatic pressures. Defects were selected for their model properties in a family of hosts and have included isoelectronic deep traps and resonances, shallow and deep simple donors and acceptors, and native-defect and impurity complexes incorporated during crystal growth or by implantation and annealing or diffusion. Materials included MOCVD-, MBE-, Cl-transport-VPE-, or LPE-prepared 3-5 compounds (e.g., GaAs, InP, GaP, AlP, and AlAs) and certain of their alloys; and thin-film amorphous silicon and germanium. GRA

**N86-23470#** Stanford Univ., Calif. Dept. of Materials Science and Engineering.
**DIFFUSION AND DEFECT CHARACTERIZATION STUDIES OF MERCURY CADMIUM TELLURIDE Report, 1 Aug. 1984 - 31 Jan. 1985**
1985 4 p
(Contract N00014-84-K-0423; ARPA Order 5019)
(AD-A162586) Avail: NTIS HC A02/MF A01 CSCL 20/12

Two major areas are under study: epitaxial film growth of Hg1-xCdxTe(MCT); and diffusion in MCT. The objective of the film growth study is to evaluate mechanisms of the film growth process and to provide samples for property and device study in MCT. The objectives of the diffusion studies are to resolve inconsistencies in the literature regarding this important practical phenomenonal and to elucidate the dominant defects present in this ternary compound. A brief description of current activity and progress is given. GRA

**N86-23471#** California Univ., Berkeley. Lawrence Berkeley Lab.
**NONLINEAR DYNAMICS OF SOLID STATE SYSTEMS**
C. D. Jeffries Aug. 1985 17 p refs Presented at the Conference on Perspectives in Nonlinear Dynamics, Washington, D.C., 28 May 1985
(Contract DE-AC03-76SF-00098)
(DE86-001479; LBL-20177; CONF-8505207-1) Avail: NTIS HC A02/MF A01

A short review is given of a number of phenomena in solid state physics which display nonlinear dynamics. Two examples are discussed in more detail: plasma waves in germanium crystals and spin waves in ferrites. Solids are often well characterized and have diverse properties; they are quite interesting from the viewpoint of experimental and theoretical nonlinear dynamicists. A fundamental understanding of their dynamics will have significant bearing on solid state device technology and applications. DOE

**N86-23472#** California Univ., Berkeley. Lawrence Berkeley Lab.
**SUPERCONDUCTING QUANTUM DEVICES. SUMMARY AND CONCLUSIONS**
J. Clark Aug. 1985 12 p Presented at the 3rd International Conference on Superconducting Quantum Devices, Berlin, West Germany, 25 Jun. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001978; LBL-20059; CONF-8506203-4) Avail: NTIS HC A02/MF A01

Looking back over this, the third IC SQUID conference, and trying to compare the state of our field now with the way it was at the time of the second conference in 1980, the author realized that while there has been tremendous progress in some areas, in others there have been considerable disappointments and setbacks. In attempting to assess the many things that we have heard in the last four days, some idea of the status of the various subdivisions of the field was given. DOE

**N86-23473#** Sandia National Labs., Albuquerque, N. Mex.
**CHEMISTRY OF GRAIN BOUNDARY AND BULK HYDROGEN IN POLYSILICON**
D. S. Ginley and D. M. Haaland 1985 10 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002167; SAND-85-1565C; CONF-851043-15) Avail: NTIS HC A02/MF A01

Results are summarized on kinetic modeling and Fourier

transform infrared studies of the grain boundary passivation of polycrystalline silicon with monatomic hydrogen plasmas. By studying the electrical conductivity of polysilicon as a function of depth and time, considerable insight has been obtained concerning the overall pattern of hydrogen flow into the boundaries, and diffusion coefficients have been determined. In addition, FT-IR spectroscopy has yielded information about the detailed nature of the passivated sites and the exchange of hydrogen between sites during high temperature annealing. However, direct correlation between infrared band intensities and electrical conductivity have not been observed for treated polysilicon. In this paper we summarize our recent results in these two areas, discuss some limitations of these studies and pose important questions which need to be resolved. DOE

**N86-23474#** California Univ., Berkeley. Lawrence Berkeley Lab.
**KINETICS OF PARTICLE VAPOR EQUILIBRIUM**
A. W. Searcy Oct. 1985 6 p refs Presented at the 168th Meeting of the Electrochemical Society, Las Vegas, Nev., 13 Oct. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002869; LBL-20408; CONF-851048-8) Avail: NTIS HC A02/MF A01

A standard formulation of reaction kinetics is used to derive the condition for dynamic equilibrium between a crystalline particle and its self-adsorption layer. The result, when combined with the well-known condition for adsorption layer-vapor equilibrium, yields an expression for the relationship between the equilibrium vapor pressure and a vacancy-molecule distribution function for the particle. The effects of particle shape and size on vapor pressures are different from those of the Kelvin equation, but are consistent with the thermodynamic requirements that the internal free energy of the particle be a minimum at constant T and P. The classical theory, which neglects vacancies, is not. DOE

**N86-23475#** California Univ., Berkeley. Lawrence Berkeley Lab.
**INVESTIGATION OF NONRADIATIVE RECOMBINATION IN SEMICONDUCTORS BY PHOTOTHERMAL DISPLACEMENT SPECTROSCOPY**
H. Dersch and N. M. Amer Jun. 1985 6 p refs Presented at the 4th International Topical Meeting on Photoacoustic, Thermal and Related Sciences, Quebec, Canada, 4 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002882; LBL-20190; CONF-850886-3) Avail: NTIS HC A02/MF A01

The dynamics of nonradiative recombination processes are investigated by measuring the thermal expansion and subsequent displacement of a sample surface caused by the absorption of a modulated laser beam. DOE

**N86-23476#** Argonne National Lab., Ill.
**HIGH FIELD PROPERTIES OF NbN RIBBON CONDUCTORS**
D. W. Capone, II, R. T. Kampwirth, and K. E. Gray Aug. 1985 4 p Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985
(Contract W-31-109-eng-38)
(DE85-018340; CONF-850814-30) Avail: NTIS HC A02/MF A01

This paper reports the first high field measurements on ribbon conductors composed of NbN and Cu deposited onto Hastelloy ribbons. These ribbons are 5 to 8 cm long, 1/8" wide, and have several microns of NbN, covered with several microns of Cu, deposited onto one side. Such samples have a T/sub c/ approx. 14.5 K, H/sub c2/ (2.0 K) approx. 26 T in the parallel direction and J/sub c/ (20 T, 2.0 K) up to 3 x 10(4) A/cm(2). DOE

**N86-23477#** Oak Ridge National Lab., Tenn.
**DAMAGE ACCUMULATION IN CERAMICS DURING ION IMPLANTATION**
C. J. McHargue, G. C. Farlow, G. M. Begun, J. M. Williams, C. W. White, B. R. Appleton, P. S. Sklad, and P. Angelini 1985 24 p Presented at the TMS/AIME Fall Meeting, Toronto, Canada, 13 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-001360; CONF-8510168-2) Avail: NTIS HC A02/MF A01

The damage structures of (ALPHA)-Al2O3 and (ALPHA)-SiC were examined as functions of ion implantation parameters using Rutherford backscattering-channeling, analytical electron microscopy, and Raman spectroscopy. Low temperatures or high fluences of cations favor formation of the amorphous state. At 300K, mass of the bombarding species has only a small effect on residual damage, but certain ion species appear to stabilize the damage microstructure and increase the rate of approach to the amorphous state. The type of chemical bonding present in the host lattice is an important factor in determining the residual damage state. DOE

**N86-23478#** Naples Univ. (Italy). Dipartimento di Fisica Nucleare.
**SUPERCONDUCTIVE TUNNEL STRUCTURES AS RADIATION DETECTORS**
A. Barone and K. E. Gray Aug. 1985 6 p refs Presented at the 3rd International Conference on Superconducting Quantum Devices, Berlin, West Germany, 25 Jun. 1985 Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(DE86-001797; CONF-8506203-2) Avail: NTIS HC A02/MF A01

A brief review is given on various aspects of the potential of superconducting tunnel junctions as detectors for atomic and nuclear radiations. On the basis of recent results main advantages and drawbacks are indicated providing a preliminary comparison with the presently used semiconductor detectors. The basic ideas underlying the physics of the interaction of nuclear particles and other radiations with superconducting junctions are outlined. DOE

**N86-23479#** California Univ., Los Angeles. School of Engineering and Applied Science.
**EPITAXIAL OVERGROWTH OF Si ON SiO2 FILM**
A. S. Yue Mar. 1985 17 p
(Contract W-7405-eng-48)
(DE86-002597; UCRL-15675) Avail: NTIS HC A02/MF A01

The novel approach to increase the performance of semiconductor devices is proposed. This approach is based on the concept of three-dimensional device fabrication where a single-crystalline Si layer is electrically isolated from a similar Si layer by a SiO2 film. The growth of this single-crystalline Si layer is accomplished by an epitaxial growth of Si on slots of the seed region of a Si substrate bordered with a SiO2 film and the overgrowth of Si on top of the SiO2 surface by the CVD technique. The single-crystallinity of the epilayer has been revealed by the presence of Kikuchi lines on its surface. DOE

**N86-23480#** National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
**DEVELOPMENT OF STANDARDS FOR SUPERCONDUCTORS Interim Report, Jan. 1982 - Dec. 1983**
L. F. Goodrich, J. V. Minervini, A. F. Clakr, F. R. Fickett, and J. W. Ekin Jan. 1985 168 p
(Contract DE-AI01-76PR-06010)
(PB86-128733; NBSIR-85-3027) Avail: NTIS HC A08/MF A01 CSCL 20L

A cooperative program with the Department of Energy, the National Bureau of Standards, and private industry is in progress to develop standard measurement practices for use in large scale applications of superconductivity. The goal is the adoption of voluntary standards for the critical parameters and other characterizations of practical superconductors. Progress for the period January 82 through December 1983 is reported. The major effort was the procurement, selection, and certification of the first superconducting wire for critical current measurements as a Standard Reference Material (SRM 1457). Other work reported here includes: effect of geometry on current transfer; lap-joint resistance; and ac losses. GRA

**N86-22756#** Joint Publications Research Service, Arlington, Va.
**RING DEFECT OF GaAs STUDIED**

Jianbang Chen and Guoli Zhang *In its* China Report: Science and Technology (JPRS-CST-86-003) 27 Jan. 1986 p 118-122 Transl. into ENGLISH from Xiyou Jinshu (Beijing, China), v. 9, no. 4, Jul. 1985 p 21-23 (For primary document see N86-22748 13-31)
Avail: NTIS HC A07/MF A01

# 77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

**N86-23481** Maryland Univ., College Park.
**A DESCRIPTION OF THE CROSSOVER FROM THE CRITICAL TO THE CLASSICAL BEHAVIOR OF THE THERMODYNAMIC PROPERTIES OF FLUIDS Ph.D. Thesis**
Penrose Carballo Albright 1985 191 p
Avail: Univ. Microfilms Order No. DA8523047

A description of the thermophysical properties of pure fluids that is valid in, as well as away from, the critical region is presented. This crossover theory provides an accurate description of pure fluids near the critical point, yet evolves into classical behavior away from the critical point. The theory is well motivated within the renormalization group theory. The asymptotic (critical) theory is estimated. The renormalization group theory is presented, with emphasis put on those parts of the formalism needed to describe the crossover to the classical regime. The symmetric theory, appropriate for magnetic systems, is presented first; the changes needed to describe asymmetric systems, such as fluids, are then described. The transition from a magnetic theory is completed by considering the thermodynamic symmetries of fluid systems. The phenomenology of crossover in fluids is examined, and methods for implementing a crossover theory are described. A detailed study of the van der Waals equation of state, with crossover, is presented. Dissert. Abstr.

# 80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

**N86-23482#** National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
**ACADEMIC SCIENCE/ENGINEERING: R AND D FUNDS, FISCAL YEAR 1983 (DETAILED STATISTICAL TABLES)**
Apr. 1985 159 p
(PB86-120706; NSF-85-308) Avail: NTIS HC A08/MF A01 CSCL 05A

The report contains tabular data on 562 institutions of higher education regarding scientific and engineering (S/E) R and D expenditures that are separately budgeted. The survey includes institutions that offer a doctorate or master's degree in S/E programs, as well as those schools with $50,000 or more in separately budgeted R and D expenditures. The 19 federally financed R and D centers also are included. Data are tabulated by: (1) sources of funds; (2) S/E disciplines; (3) character of work; (4) control of institution (public/private); (5) largest performers' ranking; (6) highest degree offered; (7) total and federally financed current fund expenditures for research equipment; and (8) capital expenditures for facilities and equipment for research, development, and instruction. Trend tables are included for most elements. The methodology and response rate are described and a reproduction of the survey instrument is included. GRA

# 81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**N86-23483#** Department of Energy, Washington, D. C. Materials Sciences Div.
**MATERIALS SCIENCES PROGRAMS. FISCAL YEAR 1985**
Sep. 1985 258 p
(DE86-002089; DOE/ER-0143/3) Avail: NTIS HC A12/MF A01

The purpose of this report is to provide a convenient compilation and index of the DOE Materials Sciences Division programs. This compilation is primarily intended for use by administrators, managers, and scientists to help coordinate research. The report is divided into six sections. Section A contains all Laboratory projects, Section B has all contract research projects, Section C has projects funded under the Small Business Innovation Research Program, Sections D and E have information on DOE collaborative research centers, Section F gives distribution of funding, and Section G has various indexes. DOE

**N86-23484#** National Science Foundation, Washington, D.C.
**GUIDE TO PROGRAMS, FISCAL YEAR 1986: GUIDE DESCRIBING NATIONAL SCIENCE FOUNDATION PROGRAMS AND ACTIVITIES**
Oct. 1985 90 p
(PB86-125184; NSF-85-40) Avail: NTIS HC A05/MF A01 CSCL 05A

The guide describes all of the Foundation's programs and activities. It is divided into chapters reflecting NSF's major divisions and details the areas of scientific and engineering research supported by each. Also included: a current NSF organization chart and the National Science Board's Criteria for the Selection of Research Projects. Author

**N86-23485#** National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
**FEDERAL SCIENTIFIC AND TECHNICAL WORKERS: NUMBERS AND CHARACTERISTICS, 1973 AND 1983 Final Report**
Feb. 1985 42 p
(PB86-116670; NSF-85-312) Avail: NTIS HC A03/MF A01 CSCL 05A

The report, utilizing data from the Office of Personnel Management, examines trends between 1973 and 1983 in the magnitude, as well as the demographic and employment characteristics of federally employed scientists, engineers, and technicians (SET). Relying on data for 1973 and 1983, it compares major differences between Federal and other SET over the ten-year period, and key aspects of the changing composition of Federal SET. It also provides a wide-ranging look at Federal personnel trained as scientists or engineers, but who work in other areas. The following variables were used in the report: field of specialization, agency, age, sex, work activity, state, highest degree level and field, management/supervisory status, minority status, and non-science/engineering field. GRA

**N86-23486#** National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
**FEDERAL SUPPORT TO UNIVERSITIES, COLLEGES, AND SELECTED NONPROFIT INSTITUTIONS: FISCAL YEAR 1983 Final Report**
Oct. 1985 227 p
(PB86-119104; NSF-85-321) Avail: NTIS HC A11/MF A01 CSCL 05A

The report presents data from the National Science Foundation's annual Survey of Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, FY 1983. Obligations to the federally funded research and development centers (FFRDC's) administered by both universities and nonprofit institutions are reported separately. The survey is confined to the 15 Federal agencies that account for an estimated 95 percent of all obligations to universities and colleges and virtually all science and engineering

(S/E) funding for research and development to these institutions. The data are tabulated by: (1) source of funding; (2) type of activity; (3) S/E discipline; (4) geographic distribution; (5) institutional control (public/private); (6) rankings of recipients; and (7) highest degree offered. Trend tables are included for most distribution. GRA

**N86-23487#** Office of Technology Assessment, Washington, D.C.
**US-SOVIET COOPERATION IN SPACE**
Jul. 1985 113 p
(PB86-114758; OTA-TM-STI-27; LC-85-600561) Avail: NTIS HC A06/MF A01 CSCL 05A

This technical memorandum outlines the principal issues of the debate, the history and cooperation, and the experience of France, another country involved in space cooperation with the USSR. From a scientific and practical point of view, past experience has shown that cooperation in space can lead to substantive gains in some areas of space research and applications and can provide the US with improved insight into the Soviet space program and Soviet society as a whole. Past experience suggests that technology transfer from the US to the USSR will remain a major countervailing concern in any future space cooperation. GRA

# 82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

**N86-23488#** Sandia National Labs., Albuquerque, N. Mex.
**INTERACTIVE PORTABLE DOCUMENTATION PROGRAM FOR A MATHEMATICAL SUBROUTINE LIBRARY, REVISION 1**
D. D. Jones and R. J. Hanson Oct. 1985 39 p refs
(Contract DE-AC04-76DP-00789)
(DE86-002514; SAND-85-0877) Avail: NTIS HC A03/MF A01

An interactive documentation processor has been developed. It allows users of large mathematical subroutine packages to selectively obtain information by subroutine name, author, keyword, and category. It also provides selective information on subroutine linkage, calling sequences, table of contents, and local library information. It is written in portable FORTRAN with a small number of machine-dependent subroutines that are available for a wide variety of machines. The program is designed to run interactively and provides a self-documenting, or HELP capability. It has been applied to documenting the SLATEC Mathematical Subroutine Library. DOE

**N86-23489#** Oak Ridge National Lab., Tenn.
**THE 1983 INTEGRATED DATA USERS WORKSHOP: PROCEEDINGS, SUMMARY**
R. J. Olson, ed. and N. T. Millemann, ed. Oct. 1985 100 p The 4th Integrated Data Users Workshop held at Reston, Va., 1 Nov. 1983
(DE86-001444; CONF-831117-Summ) Avail: NTIS HC A05/MF A01

The Integrated Data Users Group (IDUG) is composed of people from various federal agencies and other organizations who have chosen to participate in a forum for exchange of information regarding use of integrated data. Integrated data are environmental, health, and socioeconomic data that are often found in large files, are ususally machine-readable, are frequently geographically oriented, cover large areas that may include the entire United States, and otherwise require combining data of dissimilar types and origins. The key field for merging files is usually a geographic area. Counties in the United States are commonly used geographic units, but other areas such as river basins may be used. The group's purpose is to address problems that cannot be adequately addressed using data from a single study or survey but require integration of data from different files. The goals are: (1) to increase our knowledge of the existence and availability of pertinent data bases; (2) to encourage transfer of those data among users; (3) to improve use of data file standards for completeness, accuracy, comparability to published sources, documentation, codes and nomenclatures; and (4) to promote development and use of affordable, simple, practical methods of acquiring, processing, evaluating, and reporting integrated data. The primary means of achieving these goals is through the annual Integrated Data Users Workshop. The conference sessions included: integrated data systems in the context of foresight and strategic planning; data clearinghouse roles and functions; data quality issues; socioeconomic and demographic data issues in data integration; political and economic barriers to data integrating; numeric data referral centers/clearinghouses; integrated systems in the context of anticipated technological changes; qualtiy assurance obligations for integrated data users; and practical applications of integrated data approaches. DOE

**N86-23490#** Commission of the European Communities, Petten (Netherlands). Directorate General 12: Science, Research and Development.
**FACTUAL MATERIAL DATA BANKS**
H. Kroeckel, K. W. Reynard, and G. Steven Luxembourg Commission of the European Communities 1985 181 p refs Presented at Commission of European Communities (CEC) Workshop, Petten, Netherlands, 14-16 Nov. 1984
(CD-NA-85-006-EN-C; EUR-9768-EN; ISBN-92-825-5322-1) Avail: NTIS HC A09/MF A01

Data bases of machine-readable factual data on technical properties of engineering materials were discussed. Author (ESA)

# 83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

# 84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

# 85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

**N86-23491#** Politecnico di Torino (Italy). Dept. of Aerospace Engineering.
**[ACTIVITIES REPORT OF THE DEPARTMENT OF AEROSPACE ENGINEERING] Annual Report, 1984**
Jul. 1985 35 p refs
Avail: NTIS HC A03/MF A01

Research activities in aeronautics and astronautics; fluid dynamics and propulsion; structures and materials; and systems engineering and management are summarized. Author (ESA)

**N86-23492#** Loughborough Univ. of Technology (England). Dept. of Transport Technology.
**SURVEY OF TRANSPORT SERVICE PROVISION IN NORTH WEST LEICESTERSHIRE Final Report**
D. Gillingwater and J. Sutton Aug. 1985 68 p refs
(TT-8502) Avail: NTIS HC A04/MF A01

Conventional bus services, school buses, social services transport, voluntary sector transport, and the ambulance service in an English county were surveyed. Transport needs and possible improvements are discussed. Author (ESA)

# 88 SPACE SCIENCES (GENERAL)

**N86-23493*#** National Aeronautics and Space Administration, Washington, D.C.
**INTERRELATIONSHIPS AMONG CIRCUMSTELLAR, INTERSTELLAR AND INTERPLANETARY DUST**
Joseph A. Nuth, III, ed. and Robert E. Stencel, ed. Jan. 1986 351 p refs Workshop held in Wye, Md., 27 Feb. - 1 Mar. 1985 (NASA-CP-2403; NAS 1.55:2403) Avail: NTIS HC A16/MF A01 CSCL 03B

Proceedings of a workshop held from February 27 to March 1, 1985. The workshop was attended by 50 astronomers, astrophysicists, planetary scientists and meteoriticists; and emphasized the interdisciplinary nature of studies of cosmic dust. For individual titles, see N86-23494 through N86-23524.

**N86-23494*#** California Univ., Los Angeles. Dept. of Astronomy.
**OBSERVATIONAL CONSTRAINTS ON CIRCUMSTELLAR DUST** **c90**
M. Jura *In* NASA, Washington. Interrleationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 3-18 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

There is an enormous range in the properties of stars that are losing mass. The red giants responsible for injecting roughly half or more of the material into the interstellar medium are reviewed. The physical properties are described for the out flowing gases. Broadband observation constaints on the dust are described by use of spectrum analysis. Circumstellar dust is identified by carbon-carbon and carbon-hydrogen bonds. B.G.

**N86-23495*#** Princeton Univ. Observatory, N. J.
**CIRCUMSTELLAR GRAIN FORMATION** **c90**
B. T. Draine *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplantary Dust Jan. 1986 p 19-28 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Dust formation around cool giant and supergiant stars is examined in terms of grain formulation. Optical properties of small clusters, molecular physics of cluster nucleation and growth, circumstellar mass flows, and their application to alpha Ori are discussed. B.G.

**N86-23496*#** Wisconsin Univ., Madison.
**OBSERVATIONS AND THEORIES OF INTERSTELLAR DUST** **c90**
John S. Mathis *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 29-36 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The observational properties of dust are summarized based on: the extinction over a factor of 100 in wavelength (0.1 to 10 microns); polarization, both linear and circular; narrow emission and absorption features in the spectrom; and reflection nebulae. Author

**N86-23497*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**SHOCK PROCESSING OF INTERSTELLAR GRAINS** **c90**
C. Gregory Seab and J. Michael Shull (Colorado Univ., Boulder) *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 37-54 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Shock processing plays an important role in the life of a typical interstellar grain. Shocks of 100 km/s-l or greater can destroy about 50% of the grain material under appropriate preshock conditions of density and magnetic field. The destruction occurs by grain-grain collisions and nonthermal sputtering for steady state radiative shocks and by thermal sputtering for fast adiabatic shocks. The evaluation of the lifetime of grains against shock destruction depends on models of the interstellar medium (ISM) structure and on supernova remnants (SNR) evolution. Results from various authors give lifetimes between 10 to the 8th and 10 to the 9th power years, compared to typical injection times for new grains of a few times 10 to the 9th power years. These numbers require that a major portion of the interstellar silicon bearing grain material must be formed by grain growth in the ISM. At the same time, the presence of isotopic anomalies in some meteorites implies that at least some grains must survive from their formation in SNRs or red giant winds through incorporation into the solar system. Author

**N86-23498*#** Washington Univ., St. Louis, Mo. Dept. of Physics.
**LABORATORY STUDIES OF INTERPLANETARY DUST** **c90**
R. M. Walker *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 55-70 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Interplanetary dust particles (IDPs) are a form of primitive extraterrestrial material. In spite of the formidable experimental problems in working with particles that are too small to be seen with the naked eye, it has proven possible to obtain considerable information concerning their properties and possible origins. Dust particles collected in the stratosphere were reviewed. These particles are the best available samples of interplanetary dust and were studied using a variety of analytical techniques. Author

**N86-23499*#** California Univ., Los Angeles. Inst. of Geophysics.
**PRIMORDIAL MATERIAL IN METEORITES** **c90**
John F. Kerridge *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 71-108 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Primordial is a term which applied to material that entered the solar system early and became incorporated into a meteorite without totally losing its identity. Identification of such material surviving in meteorites is so far solely through recognition of anomalous isotopic compositions of generally macroscopic entities contained within those meteorites. Isotopic anomalies are, by definition, isotopic compositions which differ from the canonical solar system abundances in ways which cannot be explained in terms of local processes such as mass dependent fractionation, cosmic ray induced spallation or decay of radionuclides. A comprehensive account of isotopic anomalies is impractical here, so it is necessary to be selective. Issues which are potentially addressable through the study of such primordial material are examined. Those issues will be illustrated with specific, but not exhaustive, examples. B.G.

**N86-23500*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EXPERIMENTAL INVESTIGATIONS RELATING TO THE PROPERTIES AND FORMATION OF COSMIC GRAINS** **c90**
Bertram Donn *In* NASA, Washington Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 109-134 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The interpretation of observations or theoretical analyses of

interstellar processes requires a sound knowledge of relevant data. In many instances this can only be obtained by experiments carried out under appropriate conditions. The availability of such data applicable to the subject and the techniques for obtaining the data are surveyed. Author

**N86-23501*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CIRCUMSTELLAR DUST** **c90**
Eli Dwek et al *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 17 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The presence of dust in the general interstellar medium is inferred from the extinction, polarization, and scattering of starlight; the presence of dark nebulae; interstellar depletions; the observed infrared emission around certain stars and various types of interstellar clouds. Interstellar grains are subject to various destruction mechanisms that reduce their size or even completely destroy them. A continuous source of newly formed dust must therefore be present for dust to exist in the various phases of the interstellar medium (ISM). The working group has the following goals: (1) review the evidences for the formation of dust in the various sources; (2) examine the clues to the nature and composition of the dust; (3) review the status of grain formation theories; (4) examine any evidence for the processing of the dust prior to its injection into the interstellar medium; and (5) estimate the relative contribution of the various sources to the interstellar dust population. Author

**N86-23502*#** Colorado Univ., Boulder.
**INTERSTELLAR GRAINS** **c90**
T. P. Snow et al *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 14 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

There are few aspects of interstellar grains that can be unambiguously defined. Very little can be said that is independent of models or presuppositions; hence issues are raised and questions categorized, rather than providing definitive answers. The questions are issues fall into three general areas; the general physical and chemical nature of the grains; the processes by which they are formed and destroyed; and future observational approaches. Author

**N86-23503*#** Smithsonian Astrophysical Observatory, Cambridge, Mass.
**INTERSTELLAR MATERIAL IN THE SOLAR SYSTEM** **c90**
John A. Wood et al *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 46 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

All the substance of the Earth and other terrestrial planets once existed in the form of interstellar grains and gas. A major aspect of solar system formation (and undoubtedly of star formation generally) is the complex series of processes that converted infalling interstellar grains into planets. A cryptic record of these processes is preserved in certain samples of planetary materials, such as chondritic meteorites, that were preserved in a relatively unchanged form since the beginning. It is to be expected that some of these primitive materials might contain or even consist of preserved presolar interstellar grains. The identification and study of such grains, the ancestors of our planetary system, is a matter of intense interest. Types of primitive material accessible or potentially accessible, and component of or relationship to presolar interstellar grains are discussed. Author

**N86-23504*#** New York Univ., New York.
**WORKING GROUP ON CIRCUMSTELLAR/INTERSTELLAR RELATIONSHIPS** **c90**
A. E. Glassgold *In* NASA, Washington Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 6 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Stars of various types are believed to be the main source of interstellar (IS) dust grans. The most important confirmed source is evolved giant and supergiant stars. Supernovae also contribute to the mass loss. The differences between circumstellar (CS) and IS dust were reviewed using the following topics: alteration of CS dust grains, size distribution, space observation of CS and IS dust, comparison of infrared spectra, isotopic signatures, Magellanic clouds and nearby galaxies, life cycles of dust grains, and physical and chemical data. B.G.

**N86-23505*#** Rice Univ., Houston, Tex.
**INTERRELATIONSHIPS BETWEEN INTERSTELLAR AND INTERPLANETARY GRAINS** **c90**
D. D. Clayton *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 36 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The relationship between solar system dust (SSD) and interstellar dust particles (ISMD) is being reconsidered because of the discovery of isotopic anomalies in meteorites. Meteoritic, circumstellar/meteoritic, interstellar/meteoritic, planetary, and cometary data are reviewed. B.G.

**N86-23506*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**IONIZED POLYCYCLIC AROMATIC HYDROCARBONS IN SPACE** **c90**
Lou Allamandola, John Barker (SRI International), Mike Crawford (California Univ., Berkeley), Xander Tielens (California Univ., Berkeley), and Gerard vanderZwet (Leiden Univ.) *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 2 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The mid-infrared spectrum of a continuously increasing number of stellar objects, planetary and reflection nebulae, H-II regions and extragalactic sources show a distinctive set of broad emission features at 3.3, 3.4, 6.2, 7.7, 8.6, and 11.3 micron known collectively as the unidentified infrared emission bands. A model is summarized in which the bands arise from positively charged polycyclic hydrocarbons (PAH's) on the basis of their low ionization potential and the excellent agreement between the emission bands and laboratory spectra of auto exhaust which contains these types of molecules. The proposed presence of PAHs in such a variety of objects points to their presence in the interstellar medium. Out of a previously published collection of solid state PAH radical cation spectra five were selected on the basis of the unique thermodynamic stability of their carrier and compared directly to the wavelengths of the DIB's. Although the match seems quite favorable, strongly suggesting that PAH radicals are the long sought after carrier of the diffuse interstellar absorption bands, much laboratory work must be done to test this hypothesis. B.G.

**N86-23507*#** Arizona State Univ., Tempe. Dept. of Geology.
**CLEAN VERSUS DIRTY SILICATE GRAINS AND THE STATE OF CARBON CRYSTALLIZATION IN INTERSTELLAR AND CIRCUMSTELLAR DUST** **c90**
Peter R. Buseck *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 2 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Possible compounds for the 9.7 micron spectral feature and the 2175A spectral bump are examined. Results from electron microscopy and high resolution transmission electron microscopy are discussed. Author

**N86-23508*#** Rice Univ., Houston, Tex.
**EXCESS DEPLETION OF Al, Ca, Ti FROM INTERSTELLAR GAS** **c90**
Donald D. Clayton *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)

Avail: NTIS HC A16/MF A01 CSCL 03B

Thermal condensation, cold sticking, and sputtering by interstellar shock are combined with a chemical memory of the condensation sequence to account for depletion of aluminum, calcium, and titanium in interstellar gas. The extra depletion of aluminum and calcium becomes an indicator of the structural history of the refractory parts of interstellar grains. B.G.

**N86-23509*#** Paris VII Univ. (France).
**PREGRAPHITIC MOLECULES AND THE RED-RECTANGLE EMISSION c90**
L. dHendecourt and A. Leger *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

In light of the recent identification of an infrared emission band at 3.3, 6.2, 7.7, 8.6, and 11 microns as emissions from pregraphitic molecules, the possibility that a large broad emission bump in the red part of the spectrum of the Red-Rectangle (AFGL 918) nebula is luminescence from the same molecules was investigated. The abundance, luminescence yield of the carrier, and the phosphorescence is discussed. B.G.

**N86-23510*#** National Aeronautics and Space Administration, Washington, D.C.
**IUE AND IRAS OBSERVATIONS OF LUMINOUS M STARS WITH VARYING GAS-TO DUST RATIOS c90**
Wendy Hagen (New Mexico Univ., Albuquerque), Kenneth G. Carpenter (JILA), and Robert E. Stencel *In its* Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Circumstellar gas and dust surrounding M giants and supergiants show luminous M stars to split into two distinct classes. Stars with a high gas to dust ratio all show chromospheric Ca II, H, and K emission. Stars with a high dust to gas ratio do not show chromospheric Ca II emission but are the only ones to show Balmer emission indicative of atmospheric shocks and are also the only ones to show maser emission. In order to determine whether all chromospheric indicators disappear in high dust to gas ratio stars, a survey of stars in both these classes was conducted with the IUE satellite. Long wavelength infrared fluxes for the program stars were obtained from the IRAS point source catalog. There is no obvious difference in the long wavelength observations between the two groups of stars. The long wavelength excess tends to follow the 10 micron excess and not the dust to gas ratio. B.G.

**N86-23511*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**THE NATURE OF COMETARY GRAINS FROM REMOTE SENSING c90**
Martha S. Hanner *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Physical property data of cometary grains are derived primarily from thermal emission measurement and optical scattering. Results consistent with the properties of micrometeorites collected in the stratosphere are described. B.G.

**N86-23512*#** HY-Tech Research Corp., Radford, Va.
**AN EXPERIMENTAL STUDY OF PLASMA GRAIN INTERACTIONS c90**
R. C. Hazelton and E. J. Yadlowsky *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 2 p refs Sponsored in part by Aerospace Corp. (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Dust grains occur throughout the universe in many systems such as protostellar dust clouds, planetary ring structures and in a near earth environment as the result of man's activities. These grains interact with the local plasma and radiation environment and this interaction certainly influences the evolution of the dust grains. The interaction of bismuth dust particles were studied with a background plasma. Author

**N86-23513*#** Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
**LABORATORY STUDIES OF THE INFRARED SMALL-PARTICLE EXTINCTION OF AMORPHOUS SILICATES c90**
W. Kraetschmer *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 3 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The broad interstellar IR extinction features located at 9.7 and 18 microns wavelength are believed to originate from silicate dust grains. Cosmic abundances suggest that the silicate should have a chemical composition similar to that of olivine, (Mg,Fe)2 SiO4. Olivine is a very common terrestrial silicate mineral of crystalline structure. However, crystalline olivine grains do not fit the interstellar features well. Based on spectroscopic data obtained in laboratory studies and astronomical observations it was concluded that the interstellar silicate grains consist of a material with amorphous rather than crystalline structure. The astronomical arguments and the results obtained in our laboratory experiments which support this view are reviewed. Author

**N86-23514*#** Paris VII Univ. (France). Groupe de Physique des Solides de l'ENS.
**ARE AROMATIC HYDROCARBONS THE CARRIERS OF THE DIFFUSE INTERSTELLAR BANDS IN THE VISIBLE? Abstract Only c90**
A. Leger and L. dHendecourt *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Large Polycyclic Aromatic Hydrocarbons (PAH) are the likely origin of the Unidentified Infrared Emission Feature. The molecules or their ions are also attractive candidates for the carriers of the Diffuse Interstellar Bands (DIBs) in the visible range. The PAHs have optically active transitions in the visible spectrum; have the ability to survive the ultraviolet photons in the Diffuse Interstellar Medium; and are the most abundant among the detected molecular species after H2 and CO. In particular, PAHs are better candidates than the long carbon chains that were proposed previously. Author

**N86-23515*#** Wisconsin Univ., Madison.
**GRAIN ALIGNMENT BY FERROMAGNETIC IMPURITIES Abstract Only c90**
John S. Mathis *In* NASA, Washington: Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The observed wavelength dependence of linear polarization, and its variation from region to region can be explained by the following assumptions. Interstellar grains resemble interplanetary grains, in that they are composed of collections of small particles coagulated together into elongated masses. A fraction of the small particles are ferromagnetic. Presumably these are either metallic Fe or magnetite, Fe3O4. If and only if a large grain contains one or more magnetic particles is the grain aligned in the galactic magnetic field. The magnetic particles stick only to silicate grains because of chemical similarities, or (equivalently) any pure carbon grains in the diffuse interstellar medium (ISM) are too spherical to produce polarization. Grains in dense regions, such as the outer parts of molecular clouds, are larger than those in the diffuse ISM because of coagulation of the grains rather than accretion of icy mantles. These regions are known to have larger than normal values of lambda (max), the wavelength of the maximum of linear polarization. The above assumptions are sufficient to allow the calculation of the wavelength dependence of the polarization. Author

**N86-23516*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SPECTRAL CHARACTERISTICS OF DUST IN PLANETARY NEBULAE Abstract Only** **c91**
H. Moseley and R. F. Silverberg *In* NASA, Washington Interrelationships among Circumstella, Interstellar and Interplanetary Dust Jan. 1986 1 p Previously announced as N85-17873 (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Some carbon-rich planetary nebulae exhibit a strong broad emission feature beginning at Lambda which is approximately 24 microns and extending to Lambda greater than 30 microns. Thirty to 55 micron spectrophotometry of Ic 418 and NGC 6572, both of which have the strong broad emission feature, allow the wavelength dependence of the emissivity of the dust responsible for the feature to be defined. Comparison with laboratory spectra of candidate materials which are likely to condense in a carbon-rich environment suggests that the feature arises from MgS. The implications of such a strong feature arising from a relatively minor dust constituent are discussed. The environment in which MgS may be found is considered. It is speculated that MgS will be seen in objects with C/O ratios only slightly greater than one, but not in extremely carbon rich objects. In objects with much higher carbon abundances, the formation of CS consumes S so that insufficient MgS can form to exhibit the strong feature. These observations imply that the emergent far infrared spectrum of carbon-rich objects are very different depending on the abundance of the low temperature condensate MgS. Author

**N86-23517*#** California Univ., San Diego. Center for Astrophysics and Space Sciences.
**THE EFFECTS OF CHARGED DUST GRAINS ON IR MOLECULAR EXCITATION** **c90**
R. Puetter and I. Krinsky *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 4 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

A number of issues involving grain charging in the interstellar medium were discussed. Such effects include: (1) stark broadening of molecular spectral features, (2) electrostatic grain rupturing, (3) enhancements in particle-grain collision cross sections, and (4) excitation of molecular rotations and/or vibrations. Author

**N86-23518*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**WHAT PREDICTIONS CAN BE MADE ON THE NATURE OF CARBON AND CARBON-BEARING COMPOUNDS (HYDROCARBONS) IN THE INTERSTELLAR MEDIUM BASED ON STUDIES OF INTERPLANETARY DUST PARTICLES?** **c90**
Frans J. M. Rietmeijer *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 5 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The nature of hydrocarbons and properties of elemental carbon in circumstellar, interstellar, and interplanetary dust is a long standing problem in astronomy and meteorite research. The textures and crystallographical properties of poorly graphitized carbon (PGC) from carbonaceous chondrites and Chondritic Porous Aggregates (CPAs) are comparable with PGCs formed by dehydrogenation and carbonization of hydrocarbon precursors under natural terrestrial and experimental conditions. A multistage model of hydrocarbon diagenesis in CPA and carbonaceous chondrite (proto-) planetary parent bodies was proposed in which hydrocarbons are subjected to low temperature hydrous pyrolysis. Continued efforts to recognize hydrocarbons and elemental phases in CPAs may allow understanding of the multistage hydrocarbon/elemental carbon model. B.G.

**N86-23519*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**WHY DO INTERSTELLAR GRAINS EXIST? Abstract Only** **c90**
C. G. Seab, D. J. Hollenbach, C. F. McKee (California Univ., Berkeley), and A. G. G. M. Tielens (California Univ., Berkeley) *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

There exists a discrepancy between calculated destruction rates of grains in the interstellar medium and postulated sources of new grains. This problem was examined by modelling the global life cycle of grains in the galaxy. The model includes: grain destruction due to supernovae shock waves; grain injection from cool stars, planetary nebulae, star formation, novae, and supernovae; grain growth by accretion in dark clouds; and a mixing scheme between phases of the interstellar medium. Grain growth in molecular clouds is considered as a mechanism or increasing the formation rate. To decrease the shock destruction rate, several new physical processes, such as partial vaporization effects in grain-grain collisions, breakdown of the small Larmor radius approximation for betatron acceleration, and relaxation of the steady-state shock assumption are included. Author

**N86-23520*#** National Aeronautics and Space Administration, Washington, D.C.
**CHROMOSPHERIC DUST FORMATION, STELLAR MASERS AND MASS LOSS** **c90**
Robert E. Stencel *In its* Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 5 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

A multistep scenario which describes a plausible mass loss mechanism associated with red giant and related stars is outlined. The process involves triggering a condensation instability in an extended chromosphere, leading to the formation of cool, dense clouds which are conducive to the formation of molecules and dust grains. Once formed, the dust can be driven away from the star by radiation pressure. Consistency with various observed phenomena is discussed. Author

**N86-23521*#** Los Alamos National Lab., N. Mex.
**PREPARATION, ANALYSIS AND RELEASE OF SIMULATED INTERPLANETARY GRAINS INTO LOW EARTH ORBIT** **c90**
John R. Stephens, I. B. Strong, and T. D. Kunkle *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 6 p refs (For primary document see N86-23493 13-88)
(LAUR-85-1979) Avail: NTIS HC A16/MF A01 CSCL 03B

Astronomical observations which reflect the optical and dynamical properties of interstellar and interplanetary grains are the primary means of identifying the shape, size, and the chemistry of extraterrestrial grain materials. Except for recent samplings of extraterrestrial particles in near-Earth orbit and in the stratosphere observations were the only method of deducing the properties of extraterrestrial particles. In order to elucidate the detailed characteristics of observed dust, the observations must be compared with theoretical studies, some of which are discussed in this volume, or compared with terrestrial laboratory experiments. The formation and optical characterization of simulated interstellar and interplanetary dust with particular emphasis on studying the properties on irregularly shaped particles were discussed. Efforts to develop the techniques to allow dust experiments to be carried out in low-Earth orbit were discussed, thus extending the conditions under which dust experiments may be performed. Author

**N86-23522*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**INTERSTELLAR GRAIN MANTLES** **c90**
A. G. G. M. Tielens, L. J. Allamandola, J. Bregman, and F. C. Witteborn *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Interstellar molecular grain mantles are an important component of the interstellar dust inside dense molecular clouds as evidenced by the detection of absorption bands at 2.97, 3.08, 4.61, 6.0 and

6.8 microns. Mantles may also be the precursors of more complex grain mantles in the diffuse interstellar medium. The molecular composition of these icy grain mantles were calculated employing gas phase as well as grain surface reactions. The calculated mixtures consist mainly of the molecules H2O, H2CO, N2, CO, O2, H2O2, NH2, and their deuterated counterparts in varying ratios. The exact compositions depend strongly on the physical conditions in the gas phase. The absorption spectra of H2O with other molecules was studied in the laboratory. Optical constants were determined for a few selected mixtures. Extinction and polarization cross sections across the 3 micron ice band were calculated. A comparison with the observations towards BN shows that the low frequency wing observed on this feature is due to absorption by a mixture of H2O and other molecules rather than scattering by large, pure H2O ice grains. Author

**N86-23523*#** National Aeronautics and Space Administration, Washington, D.C.
**ULTRAVIOLET SPECTROSCOPY OF METEORIC DEBRIS OF COMETS c90**
Thomas J. Wdowiak (Alabama Univ., Birmingham), William R. Kubinec (Charleston Coll., S. C.), and Joseph A. Nuth *In its* Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 3 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

It is proposed to carry out slitless spectroscopy at ultraviolet wavelengths from orbit of meteoric debris associated with comets. The Eta Aquarid and Orionid/Halley and the Perseid/1962 862 Swift-Tuttle showers would be principal targets. Low light level, ultraviolet video technique will be used during night side of the orbit in a wide field, earthward viewing mode. Data will be stored in compact video cassette recorders. The experiment may be configured as a GAS package or in the HITCHHIKER mode. The latter would allow flexible pointing capability beyond that offered by shuttle orientation of the GAS package, and doubling of the data record. The 1100 to 3200 A spectral region should show emissions of atomic, ionic, and molecular species of interest on cometary and solar system studies. Author

**N86-23524*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE ELECTROSTATICS OF A DUSTY PLASMA c75**
E. C. Whipple (California Univ., San Diego), D. A. Mendis (California Univ., San Diego), and T. G. Northrop *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The potential distribution in a plasma containing dust grains were derived where the Debye length can be larger or smaller than the average intergrain spacing. Three models were treated for the grain-plasma system, with the assumption that the system of dust and plasma is charge-neutral: a permeable grain model, an impermeable grain model, and a capacitor model that does not require the nearest neighbor approximation of the other two models. A gauge-invariant form of Poisson's equation was used which is linearized about the average potential in the system. The charging currents to a grain are functions of the difference between the grain potential and this average potential. Expressions were obtained for the equilibrium potential of the grain and for the gauge-invariant capacitance between the grain and the plasma. The charge on a grain is determined by the product of this capacitance and the grain-plasma potential difference. Author

**N86-23525#** Royal Observatory, Edinburgh (Scotland).
**[ACTIVITIES REPORT IN ASTRONOMY] Annual Report, 1985**
1985 98 p refs Original contains color illustrations
(ISSN-0267-6281) Avail: NTIS HC A05/MF A01

Research in cosmology (origin and evolution of radio galaxies); quasars and galaxies with active nuclei (automated quasar detection, radio emission from optically-selected quasars, quasars which vary, Seyfert galaxies, interacting galaxies); normal galaxies (spiral galaxies, galaxies in the Virgo cluster, Carina dwarf spheroidal galaxy, Magellanic Clouds, infrared studies of extragalactic supernovae); galactic structure (kinematics of the Galactic Spheroid, the Galactic center); star formation and the interstellar medium (bipolar outflows from young stars, outflow from the Orion complex, bipolar nebulae, OH/IR stars, rotation of young stars) and solar system (terrestrial catastrophism) is summarized.
Author (ESA)

# 89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

**N86-23526** Colorado Univ., Boulder.
**OBSERVATIONAL CONSTRAINTS ON INTERSTELLAR DEPLETION MECHANISMS IN LINES OF SIGHT EXHIBITING PECULIAR EXTINCTION CURVES Ph.D. Thesis**
Charles Lynn Joseph 1985 141 p
Avail: Univ. Microfilms Order No. DA8522673

The nature of dust-gas interactions, which are capable of modifying the size distribution of the grains and thus causing changes in the selective extinction curve, are investigated through depletion studies. The gaseous abundances of 16 elements were determined for several lines of sight toward moderately reddened stars, each having a so called anomalous extinction curve. Four lines of sight in the rho Ophiuchi dark cloud complex as well as several lines of sight through the diffuse interstellar medium were also analyzed for comparison. Two approaches are used to assess the strength of density-dependent depletion processes. First, the depletion pattern from element to element for each integrated line of sight is studied with particular emphasis being given to those species that are potential discriminators between the two major competing models of grain formation and growth. In the second approach, the relative abundances of neutral atoms, which are thought to form primarily in the densest portions of interstellar clouds, are studied. Both of these constraints are then compared to a theoretical extinction curve derived from a simple model for the size distribution of the grains based on the degree of mantling. Dissert. Abstr.

**N86-23527** California Univ., San Diego.
**INFRARED STUDIES OF SEYFERT GALAXIES AND OF THE IRREGULAR GALAXY M 82 Ph.D. Thesis**
Jose Miguel Rodriguez Espinosa 1985 213 p
Avail: Univ. Microfilms Order No. DA8524578

Middle and far infrared studies of the irregular galaxy M 82 and of Seyfert galaxies are presented. M 82 was observed spectrophotometrically from 8 to 13 microns at 6 different positions selected across its 10 microns emitting region. A model is proposed which explains satisfactorily most of the observed properties of M 82 from X-ray to radio wavelengths. It is also suggested that a similar model may be applied to other active nuclei, like the emission line alaxy NGC 1614 and the classical Seyfert 1 galaxy NGC 7469. The far IR emission from Seyfert galaxies was also studied. Data analyzed are drawn from the recently released IRAS catalog. Seyfert galaxies are strong far infrared sources, but unlike the near and mid IR emission from these sources, the far IR emission does not appear to be produced by the active nucleus. Seyfert galaxies are depicted as composed of an active nucleus that powers the near and mid IR, plus a galactic envelope that supports the starburst episodes. Dissert. Abstr.

**N86-23528** Princeton Univ., N. J.
**A SEARCH FOR SHORT PERIOD PULSARS AND ITS IMPLICATION FOR THE PERIOD DISTRIBUTION OF PULSARS Ph.D. Thesis**
Grant Stokes 1985 94 p
Avail: Univ. Microfilms Order No. DA8523995

The Princeton-NRAO Phase 2 pulsar survey, carried out at 390 MHz using the 92 m telescope in Green Bank, West Virginia

was described. This search is the first to have sensitivity to pulsars with periods as short as 0.004 s over a large portion of the galactic plane. 20 new pulsars were discovered and 67 previously known ones were detected. Though 6 pulsars were detected with periods below 0.200 s, none were found with periods shorter than 0.100 s. This result places strong upper limits on the population of short period pulsars, and effectively rules out the existence of a large, previously unobserved pulsar population with periods between 0.005 and 0.100 s. The observed period distribution is in good agreement with predicted models and can be accounted for without invoking either late turn-on or spin-up of pulsars. Timing measurements were carried out for all new pulsars discovered during both Phases 1 and 2 of the Princeton-NRAO search. Dissert. Abstr.

**N86-23529#** Department of the Air Force, Washington, D.C.
**ACTIVE SECONDARY MIRROR MOUNT Patent Application**
Graham A. Horine, inventor (to Air Force) Filed 24 Sep. 1985 12 p
(AD-D012014; US-Patent-Appl-SN-779403) Avail: NTIS HC A02/MF A01 CSCL 20/6

An active secondary mirror mount is used in a telescope requiring the mount to have five degrees of freedom in movement. The spider legs are connected between the telescope tube and a central housing. Within the central housing are two concentrically mounted tubes. The outer tube is fixedly held by the central housing and the inner tube is flexibly held within the outer tube. The X-axis and Y-axis actuator rods pass through the spider legs to act upon the inner tube. The inner tube has a focus actuator mounted on one end with an actuator shaft passing through the inner tube to the other end having the secondary mirror mounted thereon. Flexures are mounted to the inner tube and have the actuator shaft passing therethrough. Author (GRA)

# 90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

**N86-23530** Rochester Univ., N. Y.
**NONRADIAL OSCILLATIONS OF NEUTRON STARS Ph.D. Thesis**
Patrick Neal McDermott 1985 223 p
Avail: Univ. Microfilms Order No. DA8516481

Realistic three component neutron star models consisting of a fluid core, solid crust, and a thin surface fluid, are capable of sustaining a wide variety of different normal modes of oscillation. There are two broad categories of oscillation modes, spheroidal and toroidal. The spheroidal modes consist of a number of subclasses: p-, f- and g-modes, well known in stellar pulsation theory, and two new classes of modes which are called s-modes and i-modes. The new modes arise from the crustal rigidity. The f- and p-modes have periods of a few tenths of milliseconds depending on the mean density of the model. There are two solid-fluid interfaces in realistic neutron star models; the core-crust boundary and the crust-surface fluid boundary. Waves can propagate on these interfaces, and normal modes of these waves are the interfacial (i) modes. The periods of the i-modes depend strongly on the local density and temperature at the interfaces. A variety of damping mechanism were investigated including: gravitation radiation, neutrino emission, electromagnetic radiation from an oscillating stellar magnetic field, nonadiabatic damping, and internal friction/viscosity. Dissert. Abstr.

**N86-23531** California Univ., Los Angeles.
**SUPERNOVA REMNANTS AND MOLECULAR CLOUDS Ph.D. Thesis**
Yi-Long Huang 1985 197 p
Avail: Univ. Microfilms Order No. DA8523181

Since reliable, direct estimates of the distances to supernova remnants (SNR) are generally unavailable, associated objects of known distance may provide a good indicator. Although the study of extragalactic supernovae suggests that Type II remnants tend to occur near large optical Population-I objects, their detection in our Galaxy is limited by heavy local obscuration. Large molecular clouds, which occur near most optical Population-I objects and are detectable up to great distances, are probably the most plausible objects to search for an association with galactic SNRs. The CO survey toward 26 SNR found that roughly half of them revealed a spatial coincidence with large clouds; most of these coincidences are probably associations, because it is statistically improbable that they result from chance superposition. Such associations are used to re-calibrate the Sigma-D relation and establish a good distance scale (a standard deviation of 28% for the uncertainty of a predicted distance) for the shell-like SNRs resultant from Type II events. Dissert. Abstr.

**N86-23532** Colorado Univ., Boulder.
**THREE-DIMENSIONAL SIMULATIONS OF SUPERNOVAE-DOMINATED INTERSTELLAR MEDIA IN DISK GALAXIES Ph.D. Thesis**
Denis Felix Coffi 1985 166 p
Avail: Univ. Microfilms Order No. DA8508845

Evolution of the interstellar media of spiral galaxies was studied on the assumption that their dynamical and thermal properties are dominated by supernova remnants (SNRs). To do this, a computer simulation was developed which uses standard SNR evolutionary solutions to redistribute mass and energy throughout a rectangular, three level grid which models the interstellar medium (SM). This comprehensive treatment includes bremsstrahlung or metal cooling, the creation and evaporation of clouds, mass injection and return from a galactic halo, multiple SNRs, and internally determined SNR lifetimes. The importance of spatially correlating supernovae sites, which can increase the global evolution rate of the (ISM) was confirmed. The simulations of primeval (zero metal abundance) galaxies revealed that the enhanced ability of bremsstrahlung-cooled SNR to transport mass can continually agitate the ISM, preventing the establishment of long lived tunnel networks. This demonstrated the inadequacy of porosity theory for predicting the topology of the ISM, because it does not account for mass transport. Dissert. Abstr.

**N86-23533** Florida Univ., Gainesville.
**STARSPOT CYCLES OF RS CANUM VENATICORUM TYPE STARS Ph.D. Thesis**
Young Woon Kang 1985 154 p
Avail: Univ. Microfilms Order No. DA8523845

The starspot model was used to account for the photometric variations of RS Canum Venaticorum binaries. The twelve light curves of eight epochs for RS CVn, eleven light curves of six epochs for AR Lac and twelve light curves of nine epochs for V711 Tau were analyzed to investigate the cyclic variations of these systems. The spot parameters, as well as other elements of the systems, were determined for each epoch by adjusting the parameters to fit the light curves. To avoid subjective parameter adjustment, the Wilson and Devinney differential correction computer program was adopted and modified for the adjustments of the spot parameters. Models were tested using one or two circular spots on the secondary stars. The adjustable parameters are latitudes, longitudes, radii, and temperatures of the spots, the surface potentials, albedos, temperatures of the two stars and the orbital inclination. The light curve fitting was done by adjusting the spot parameters and other parameters until a good fit to the entire light curve was obtained. Dissert. Abstr.

**N86-23534** California Univ., Los Angeles.
**BUOYANCY LIMITS ON MAGNETIC VISCOSITY STRESS LAW SCALINGS IN QUASI-STELLAR OBJECT ACCRETION DISK MODELS Ph.D. Thesis**
Philip Jon Sakimoto 1985 270 p
Avail: Univ. Microfilms Order No. DA8525879

Quasi-Stellar Objects (QSOs) apparently the excessively bright nuclei of distant galaxies, are thought to be powered by accretion disks surrounding supermassive black holes. Proof of this presump-

tion is hampered by major uncertainties in the viscous stress which is necessary for accretion to occur. Models generally assume an ad hoc stress law which scales the stress with the total pressure. Near the black hole, radiation pressure dominates gas pressure; scaling the stress with the radiation pressure results in disk models which are thermally unstable and optically thin. Radiation pressure scaling for the stress is not possible if the viscosity is due to turbulent magnetic Maxwell stresses. Thus, under the assumption of magnetic viscosity, radiation pressure stress law scalings are ruled out, while gas pressure stress law scalings are, in principle, possible. Differential shear in accretion disks makes all magnetic fields buoyant; therefore, complete disks models run by magnetic viscosity must account for the source of seed magnetic fields. Dissert. Abstr.

**N86-23535#** Lawrence Livermore National Lab., Calif.
**ASTROPHYSICS OF BINARY STARS, SEYFERT GALAXIES, QUASARS AND GLOBULAR CLUSTERS Final Technical Report**
W. H. Press 29 Mar. 1985 6 p Prepared in cooperation with Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
(Contract W-7405-eng-48)
(DE86-002604; UCRL-15680) Avail: NTIS HC A02/MF A01

Several problems were investigated. The time-steady accretion of gas irradiated by a self-consistently generated quasar-like continuum was studied. The observed X-ray sources near the core of the Orion molecular cloud were established to be sufficient to supply all the ionization that is needed to drive the molecular chemistry throughout that portion of the cloud in which the greatest density and diversity of molecular species is found. A new suggestion was put forth for a single pass, high gain, O(5+) ion laboratory laser at 1035 A. The only evidence for binaries in globular clusters was found to come from binaries in extreme states, cataclysmic variables, and X-ray sources. The various evolutionary paths possible for highly compact binaries in globular clusters where they come under the simultaneous influence of gravitational radiation and gravitational encounters with field stars were analyzed. The secular evolution of a highly compact binary stellar system, composed of a collapsed object and a low-mass secondary star, in the core of a globular cluster was calculated. The dynamics of the narrow line regions of Seyfert galaxies were investigated. New calculations of the soft X-ray opacity of gas having cosmic elemental abunances were developed for a variety of ionization states. Results were presented of the analysis of 28 Einstein SSS observations of 15 high X-ray luminosity quasars and Seyfert type I nuclei. DOE

**N86-23536#** California Inst. of Tech., Pasadena.
**FORMATION OF GALACTIC HALOS IN THE COLD DARK MATTER UNIVERSE: COMPUTER SIMULATIONS**
P. J. Quinn, J. K. Salmon, and W. H. Zurek 12 Sep. 1985 2 p Presented at the International Astronomical Union Meeting, Princeton, N.J., 24 Jun. 1985 Prepared in cooperation with Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-36)
(DE86-000822; LA-UR-85-3315; CONF-8506199-2) Avail: NTIS HC A02/MF A01

The formation of structure on the galactic scale in the cold dark matter, (UC OMEGA) = 1 universe is simulated. DOE

**N86-23537#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
**STUDY ON THE ANALYTIC REPRESENTATION OF HALO ORBITS Final Report**
C. Marchal Paris ESA 25 Jul. 1985 58 p refs
(Contract ESOC-5647/83-D-JS(SC))
(ONERA-RT-5/3605-SY; ESA-CR(P)-2138) Avail: NTIS HC A04/MF A01

The halo orbits about the Langrangian points L1 and L2 of the Sun-Earth system are discussed. The elliptic restricted three-body problem with the Sun at one focus and the mass Earth plus Moon at the other focus, i.e., at the barycenter of the Earth-Moon system, is solved up to the third-order. The small perturbative effects are shown to be almost negligible. For large halo orbits about the Lagrangian points L1 and L2, a third-order Lindstedt-Poincare method was developed. The two families of corresponding Halo orbits are presented. A simple stationkeeping procedure is outlined. The Lindstedt-Poincare equations program modules (FORTRAN) are given, with numerical tests.Author (ESA)

**N86-22802*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ICE ENCOUNTER OPERATIONS**
N. Fanelli and D. Morris *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 176-185 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

**N86-22803*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**USUDA DEEP SPACE CENTER SUPPORT FOR ICE**
J. P. Goodwin *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 186-196 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

**N86-22804*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ARECIBO OBSERVATORY SUPPORT OF THE US INTERNATIONAL COMETARY EXPLORER MISSION ENCOUNTER AT COMET GIACOBINI-ZINNER**
D. D. Gordon and M. T. Ward (NASA. Goddard Space Flight Center) *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 197-202 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

**N86-22807*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**INTERCONTINENTAL ANTENNA ARRAYING BY SYMBOL STREAM COMBINING AT ICE GIACOBINI-ZINNER ENCOUNTER**
W. J. Hurd, F. Pollara, M. D. Russell, B. Siev, and P. U. Winter *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 220-228 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

**N86-23494*#** California Univ., Los Angeles. Dept. of Astronomy.
**OBSERVATIONAL CONSTRAINTS ON CIRCUMSTELLAR DUST**
M. Jura *In* NASA, Washington. Interrleationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 3-18 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23495*#** Princeton Univ. Observatory, N. J.
**CIRCUMSTELLAR GRAIN FORMATION**
B. T. Draine *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplantary Dust Jan. 1986 p 19-28 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23496*#** Wisconsin Univ., Madison.
**OBSERVATIONS AND THEORIES OF INTERSTELLAR DUST**
John S. Mathis *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 29-36 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23497*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**SHOCK PROCESSING OF INTERSTELLAR GRAINS**
C. Gregory Seab and J. Michael Shull (Colorado Univ., Boulder) *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 37-54 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23498*#** Washington Univ., St. Louis, Mo. Dept. of Physics.
**LABORATORY STUDIES OF INTERPLANETARY DUST**
R. M. Walker *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 55-70 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23499*#** California Univ., Los Angeles. Inst. of Geophysics.
**PRIMORDIAL MATERIAL IN METEORITES**
John F. Kerridge *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 71-108 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23500*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EXPERIMENTAL INVESTIGATIONS RELATING TO THE PROPERTIES AND FORMATION OF COSMIC GRAINS**
Bertram Donn *In* NASA, Washington Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 p 109-134 refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23501*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CIRCUMSTELLAR DUST**
Eli Dwek et al *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 17 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23502*#** Colorado Univ., Boulder.
**INTERSTELLAR GRAINS**
T. P. Snow et al *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 14 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23503*#** Smithsonian Astrophysical Observatory, Cambridge, Mass.
**INTERSTELLAR MATERIAL IN THE SOLAR SYSTEM**
John A. Wood et al *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 46 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23504*#** New York Univ., New York.
**WORKING GROUP ON CIRCUMSTELLAR/INTERSTELLAR RELATIONSHIPS**
A. E. Glassgold *In* NASA, Washington Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 6 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23505*#** Rice Univ., Houston, Tex.
**INTERRELATIONSHIPS BETWEEN INTERSTELLAR AND INTERPLANETARY GRAINS**
D. D. Clayton *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 36 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23506*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**IONIZED POLYCYCLIC AROMATIC HYDROCARBONS IN SPACE**
Lou Allamandola, John Barker (SRI International), Mike Crawford (California Univ., Berkeley), Xander Tielens (California Univ., Berkeley), and Gerard vanderZwet (Leiden Univ.) *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 2 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23507*#** Arizona State Univ., Tempe. Dept. of Geology.
**CLEAN VERSUS DIRTY SILICATE GRAINS AND THE STATE OF CARBON CRYSTALLIZATION IN INTERSTELLAR AND CIRCUMSTELLAR DUST**
Peter R. Buseck *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 2 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23508*#** Rice Univ., Houston, Tex.
**EXCESS DEPLETION OF Al, Ca, Ti FROM INTERSTELLAR GAS**
Donald D. Clayton *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23509*#** Paris VII Univ. (France).
**PREGRAPHITIC MOLECULES AND THE RED-RECTANGLE EMISSION**
L. dHendecourt and A. Leger *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23510*#** National Aeronautics and Space Administration, Washington, D.C.
**IUE AND IRAS OBSERVATIONS OF LUMINOUS M STARS WITH VARYING GAS-TO DUST RATIOS**
Wendy Hagen (New Mexico Univ., Albuquerque), Kenneth G. Carpenter (JILA), and Robert E. Stencel *In its* Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23511*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**THE NATURE OF COMETARY GRAINS FROM REMOTE SENSING**
Martha S. Hanner *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23512*#** HY-Tech Research Corp., Radford, Va.
**AN EXPERIMENTAL STUDY OF PLASMA GRAIN INTERACTIONS**
R. C. Hazelton and E. J. Yadlowsky *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 2 p refs Sponsored in part by Aerospace Corp. (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23513*#** Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
**LABORATORY STUDIES OF THE INFRARED SMALL-PARTICLE EXTINCTION OF AMORPHOUS SILICATES**
W. Kraetschmer *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 3 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23514*#** Paris VII Univ. (France). Groupe de Physique des Solides de l'ENS.
**ARE AROMATIC HYDROCARBONS THE CARRIERS OF THE DIFFUSE INTERSTELLAR BANDS IN THE VISIBLE? Abstract Only**
A. Leger and L. dHendecourt *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493

13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23515*#** Wisconsin Univ., Madison.
**GRAIN ALIGNMENT BY FERROMAGNETIC IMPURITIES Abstract Only**
John S. Mathis *In* NASA, Washington: Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23517*#** California Univ., San Diego. Center for Astrophysics and Space Sciences.
**THE EFFECTS OF CHARGED DUST GRAINS ON IR MOLECULAR EXCITATION**
R. Puetter and I. Krinsky *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 4 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23518*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**WHAT PREDICTIONS CAN BE MADE ON THE NATURE OF CARBON AND CARBON-BEARING COMPOUNDS (HYDROCARBONS) IN THE INTERSTELLAR MEDIUM BASED ON STUDIES OF INTERPLANETARY DUST PARTICLES?**
Frans J. M. Rietmeijer *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 5 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23519*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**WHY DO INTERSTELLAR GRAINS EXIST? Abstract Only**
C. G. Seab, D. J. Hollenbach, C. F. McKee (California Univ., Berkeley), and A. G. G. M. Tielens (California Univ., Berkeley) *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23520*#** National Aeronautics and Space Administration, Washington, D.C.
**CHROMOSPHERIC DUST FORMATION, STELLAR MASERS AND MASS LOSS**
Robert E. Stencel *In its* Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 5 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23521*#** Los Alamos National Lab., N. Mex.
**PREPARATION, ANALYSIS AND RELEASE OF SIMULATED INTERPLANETARY GRAINS INTO LOW EARTH ORBIT**
John R. Stephens, I. B. Strong, and T. D. Kunkle *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 6 p refs (For primary document see N86-23493 13-88)
(LAUR-85-1979) Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23522*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**INTERSTELLAR GRAIN MANTLES**
A. G. G. M. Tielens, L. J. Allamandola, J. Bregman, and F. C. Witteborn *In* NASA, Washington. Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 1 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

**N86-23523*#** National Aeronautics and Space Administration, Washington, D.C.
**ULTRAVIOLET SPECTROSCOPY OF METEORIC DEBRIS OF COMETS**
Thomas J. Wdowiak (Alabama Univ., Birmingham), William R. Kubinec (Charleston Coll., S. C.), and Joseph A. Nuth *In its* Interrelationships among Circumstellar, Interstellar and Interplanetary Dust Jan. 1986 3 p refs (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

# 91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

**N86-23538** Florida Univ., Gainesville.
**AN OBSERVATIONALLY COMPATIBLE MODEL FOR JUPITER'S 10-RELATED DECAMETRIC EMISSION Ph.D. Thesis**
Wan-xian Wang 1985 158 p
Avail: Univ. Microfilms Order No. DA8523894

A model for Jupiter's Io-related decametric radiation was adjusted to provide a close fit to observed contours of emission occurrence probability on the plane of Io phase vs the central meridian longitude for frequencies between 35 and 36 MHz. A nonlinear indirect emission mechanism was assumed in which Io-excited Alfven waves produce an electron beam, which in turn, after intermediate steps, results in the emission of fast extraordinary mode electromagnetic waves. This radiation is emitted into a hollow cone beam attached to the Io flux tube at a point where the wave frequency is slightly higher than the electron cyclotron frequency. A five-dipole representation of Jupiter's magnetic field was developed and used in this model; it closely matches the O4 field model and has the advantage of greater computational flexibility. The Voyager determined distribution of electron number density vs height above the cloud top level was used.
Dissert. Abstr.

**N86-23539*#** National Aeronautics and Space Administration, Washington, D.C.
**PLANETARY EXPLORATION THROUGH YEAR 2000: A CORE PROGRAM, PART 1**
1983 166 p Original doc. contains color illustrations
(NASA-TM-88653; NAS 1.15:88653) Avail: NTIS Avail: SOD HC $7.00 as 033-000-00882-1 CSCL 03B

Mission definitions and priorities; target selections; program strategy; historical settings; major scientific goals; spacecraft exploration; and planetary missions are examined. B.G.

**N86-23540*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**VOYAGER AT URANUS: 1986**
1986 17 p
(NASA-CR-176706; NASA-JPL-Pub-400-268; NAS 1.26:176706)
Avail: NTIS HC A02/MF A01 CSCL 03B

The voyager 2 spacecraft begins its initial observations of Uranus November 4, 1985, and makes its final observation February 25, 1996. The data from the infrared interfermometer spectrometer, photopolarimeters, plasma wave, plasma detecter, and ultraviolet spectrometer will be processed to add a large block of information to the small amount already known. The trajectory of Voyager 2 is also discussed. B.G.

**N86-22799*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**DEEP SPACE NETWORK RADIO SCIENCE SYSTEM FOR VOYAGER URANUS AND GALILEO MISSIONS**
T. K. Peng and F. F. Donivan *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 143-151 (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

**N86-23516*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SPECTRAL CHARACTERISTICS OF DUST IN PLANETARY NEBULAE Abstract Only**
H. Moseley and R. F. Silverberg *In* NASA, Washington Interrelationships among Circumstella, Interstellar and Interplanetary Dust Jan. 1986 1 p Previously announced as N85-17873 (For primary document see N86-23493 13-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

# 92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

**N86-23541** Colorado Univ., Boulder.
**PROPERTIES OF SOLAR FLAME PLASMA DERIVED FROM SOFT X-RAY LINE EMISSION Ph.D. Thesis**
Patricia Lee Borinmann 1985 153 p
Avail: Univ. Microfilms Order No. DA8522647

A new observational property of soft X-ray line fluxes observed during the decay phase of solar flares is described and a new technique is presented for determining the plasma temperature and emission measure as functions of time based on this property. Results of this technique indicate the need for continuous heating or an intermediate energy storage mechanism during the flare. The soft X-ray line fluxes observed by SMM's FCS during the gradual phase of the 1980 November 5 flare did not decay at a constant rate. The line flux decay rate changed abruptly, with the line fluxes falling more rapidly later in the flare decay. These changes occurred at earlier times for lines formed at higher temperatures. This behavior is proposed to be due to the decreasing temperature of the flare plasma tracking the rise and subsequent fall of each line emissivity function. The proposed explanation for the rate changes was used to develop a technique for estimating the temperature and emission measure as a function of time during the gradual phase of solar flares. Dissert. Abstr.

**N86-23542** California Univ., Berkeley.
**HETERODYNE SPECTROSCOPY OF THE SUN AT 12 MICRONS USING A DIODE LASER AS THE LOCAL OSCILLATOR Ph.D. Thesis**
John Jacob Ottusch 1985 152 p
Avail: Univ. Microfilms Order No. DA8525075

A heterodyne spectrometer using a tunable diode laser as the local oscillator was constructed for astronomical observations in the mid-infrared. The bench-top sized instrument employs a single mode PbSnTe diode laser cooled to 12K or above by a helium closed cycle refrigerator, and LN2 cooled HgCdTe photodiode detector, and appropriate beam combining optics. Spectra are obtained by scanning the local oscillator frequency while measuring the heterodyne signal in a single RF channel Frequency control to about + or - 10 MHz is achieved by means of precision laser current and temperature controllers. The spectrometer was installed at the Snow Solar Telescope of the Mount Wilson Observatory where it was used to investigate four lines in the pure rotation spectrum of solar OH near 12 microns. These lines are formed in LTE and are reliable indicators of physical properties in the upper photosphere. Resolved profiles of two lines in each of the ground and first excited vibrational states of OH were measured at several locations on the solar disk. All lines could be well fit by Gaussian profiles. Dissert. Abstr.

**N86-23543#** Stanford Univ., Calif. Center for Space Science and Astrophysics.
**SUMMARY PROCEEDINGS OF THE STANDFORD WORKSHOP ON SOLAR FLARE PREDICTION HELD IN PARIS ON 28 FEBRUARY - 1 MARCH 1985**
Spiro K. Antiochos, Taeil Bai, and Peter A. Sturrock 1 Mar. 1985 53 p Workshop hel in Paris, France, 28 Feb. - 1 Mar. 1985
(Contract N00014-85-K-0111)
(AD-A162608; CSSA-ASTRO-85-22) Avail: NTIS HC A04/MF A01 CSCL 03/2

A workshop on The Prediction of Solar Activity was held at Meudon Observatory in France in June 1984. During that meeting, a number of participants from the United States expressed interest in meeting together to discuss this topic with a view to exploring what actions might be taken to improve our predictive capability. This document contains abstracts of presentations made at the meeting. GRA

**N86-23544#** Lawrence Livermore National Lab., Calif.
**RADIATION HYDRODYNAMICS IN SOLAR FLARES**
G. H. Fisher 18 Oct. 1985 28 p refs Presented at the International Astronomical Union (IAU) Colloquium, Copenhagen, Denmark, 11 Jun. 1985
(Contract W-7405-eng-48)
(DE86-002991; UCRL-93541; CONF-8506205-2) Avail: NTIS HC A03/MF A01

Solar flares are rather violent and extremely complicated phenomena, and it should be made clear at the outset that a physically complete picture describing all aspects of flares does not exist. From the wealth of data which is available, it is apparent that many different types of physical processes are involved during flares: energetic particle acceleration, rapid magnetohydrodynamic motion of complex field structures, magnetic reconnection, violent mass motion along magnetic field lines, and the heating of plasma to tens of millions of degrees, to name a few. The goal of this paper is to explore just one aspect of solar flares, namely, the interaction of hydrodynamics and radiation processes in fluid being rapidly heated along closed magnetic field lines. The models discussed are therefore necessarily restrictive, and will address only a few of the observed or observable phenomena. DOE

**N86-23545*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SOLAR WIND-MAGNETOSPHERE COUPLING AND THE DISTANT MAGNETOTAIL: ISEE-3 OBSERVATIONS**
J. A. Slavin, E. J. Smith, D. G. Sibeck, D. N. Baker, R. D. Zwickl, S. I. Akasofu, and R. P. Lepping Sep. 1985 17 p refs Presented at the Chapman Conference on Solar Wind-magnetosphere Energy Coupling, Pasadena, Calif., 12 Feb. 1985 Prepared in cooperation with Jet Propulsion Lab., Pasadena, Calif.; California Univ., Los Angeles.; Alaska Univ., Fairbanks.; Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-36)
(DE86-002386; LA-UR-85-3525; CONF-850277-5) Avail: NTIS HC A02/MF A01

ISEE-3 Geotail observations are used to investigate the relationship between the interplanetary magnetic field, substorm activity, and the distant magnetotail. Magnetic field and plasma observations are used to present evidence for the existence of a quasi-permanent, curved reconnection neutral line in the distant tail. The distance to the neutral line varies from absolute value of X = 120 to 140 R/sub e near the center of the tail to beyond absolute value of X = 200 R/sub e at the flanks. Downstream of the neutral line the plasma sheet magnetic field is shown to be negative and directly proportional to negative B/sub z in the solar wind as observed by IMP-8. V/sub x in the distant plasma sheet is also found to be proportional to IMF B/sub z with southward IMF producing the highest anti-solar flow velocities. A global dayside reconnection efficiency of 20 +- 5% is derived from the ISEE-3/IMP-8 magnetic field comparisons. Substorm activity, as measured by the AL index, produces enhanced negative B/sub z and tailward V/sub x in the distant plasma sheet in agreement with the basic predictions of the reconnection-based models of substorms. The rate of magnetic flux transfer out of the tail as a function of AL is found to be consistent with previous near-Earth studies. Similarly, the mass and energy fluxes carried by plasma sheet flow down the tail are consistent with theoretical mass and energy budgets for an open magnetosphere. In summary, the ISEE-3 Geotail observations appear to provide good support for reconnection models of solar wind-magnetosphere coupling and substorm energy rates. DOE

**N86-23546#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 491, JULY 1985. PART 1: (PROMPT REPORTS). DATA FOR JUNE 1985, MAY 1985 AND LATE DATA**
Jul. 1985 106 p
(PB86-113768; SGD-491-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 03B

Solar-Geophysical Data Report No. 491, July 9185, contains reports on the following: Detailed index for 1984 to 1985; Data for June 1985--(IUWDS Alert periods (Advance and Worldwide Solar activity indices; Solar flares, Solar radio emission, Stanford mean solar magnetic field); Data for May 1985--(Solar active regions; Sudden ionospheric disturbances, Pioneer XII interplanetary magnetic field magnitudes, Solar radio spectral observations, Cosmic ray measurements by neutron monitor, Geomagnetic indices, Radio propagation indices); Late data--(Cosmic rays; Calcium plage data). GRA

**N86-23547*#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 490, JUNE 1985. PART 1: (PROMPT REPORTS). DATA FOR MAY 1985, APRIL 1985 AND LATE DATA**
H. E. Coffey, ed. Jun. 1985 110 p
(NASA Order W-15519; Grant NSF ATM-83-18491)
(NASA-CR-176703; NAS 1.26:176703; PB86-121985; SGD-490-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 03B

Contents include: detailed index for 1984 to 1985; data for May 1985--(IUWDS alert periods (Advance and Worldwide) solar activity indices, solar flares, solar radio emission, Stanford mean solar magnetic field); data for April 1985--(solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, geomagnetic indices, radio propagation indices); and late data--(geomagnetic indices, cosmic rays, calcium plage data). GRA

**N86-23548*#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 489, MAY 1985. PART 2: (COMPREHENSIVE REPORTS). DATA FOR DECEMBER 1984, MARCH-MAY 1983 AND MISCELLANEA**
H. E. Coffey, ed. Jun. 1985 92 p
(NASA Order W-15519; Grant NSF ATM-83-18491)
(NASA-CR-176704; NAS 1.26:176704; PB86-121993; SGD-490-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 03B

Contents include: detailed index for 1984 to 1985; data for December 1984--(Meudon Carte Synoptique, solar radio bursts at fixed frequencies, solar X-ray radiation from GOES satellite graphs, mass ejections from the sun, active prominences and filaments, solar irradiance); and data for March, April and May 1983--(solar flares March 1983, solar flares April 1983, solar flares May 1983, number of flares August 1966 to May 1983). GRA

**N86-23549*#** National Geophysical Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 493, SEPTEMBER 1985. PART 1: (PROMPT REPORTS). DATA FOR AUGUST 1985, JULY 1985 AND LATE DATA**
H. E. Coffey, ed. Sep. 1985 86 p
(NASA Order W-15519; Grant NSF ATM-83-18491)
(NASA-CR-176705; NAS 1.26:176705; PB86-125457) Avail: NTIS HC A05/MF A01 CSCL 03B

Topics covered include: detailed index for 1985; data for August 1985--(IUWDS alert periods (Advanced and Worldwide), solar activity indices, solar flares, solar radio emission, Stanford mean solar magnetic field); (solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, geomagnetic indices, radio propagation indices); and late data--calcium plage data. GRA

# 93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

**N86-23550** California Univ., Berkeley.
**THE SPECTRUM OF THE COSMIC BACKGROUND RADIATION FROM 2.3/cm TO 11.0/cm Ph.D. Thesis**
Jeffrey B. Peterson 1985 123 p
Avail: Univ. Microfilms Order No. DA8525087

Measurement of the spectrum of the cosmic background radiation is described. The instrument, a balloon-borne filter photometer, is described in detail. The photometer is liquid Helium cooled and calibrated in flight with a 3.2K blackbody. Data from the first flight are analyzed. The subtraction of the atmospheric component of the flux from the sky proved to be more difficult than was expected before the flight. A slow decrease of the measured flux from the sky limited the precision of the subtraction. Despite these difficulties the spectrum was measured. All five temperatures are consistent with temperatures in the range 2.78 K + or - 0.11 K. No significant deviation from a thermal spectrum was detected. Dissert. Abstr.

**N86-23551*#** Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
**COSMIC RAY SIMULATION AND TESTING PROGRAM Final Report, Jan. - Nov. 1984**
W. A. Kolasinski, R. Koga, C. G. King, and S. I. Imamoto 15 Apr. 1985 54 p refs
(Contract NAS5-27984)
(NASA-CR-177860; NAS 1.26:177860) Avail: NTIS HC A04/MF A01 CSCL 03B

Single event upset (SEU) and latchup vulnerabilities were determined for a number of parts of interest to NASA space programs. In cases where a threshold linear energy transfer (LET) for SEU could be measured, an upset rate in a low inclination Space Shuttle orbit was computed. The predicted upset rates are extremely low, except for the devices with LET thresholds below the geomagnetic cutoff for altitude and inclination of the Space Shuttle orbit. While some of the devices do exhibit latchup, the cross sections and threshold LETs are such that the risk associated with flying these devices in low, near equatorial orbits is small if not negligible. Author

**N86-22800*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**THE SEARCH FOR REFERENCE SOURCES FOR DELTA VLBI NAVIGATION OF THE GALILEO SPACECRAFT**
J. S. Ulvestad and R. P. Linfield *In its* The Telecommunications and Data Acquisition Report 15 Feb. 1986 p 152-163 refs (For primary document see N86-22784 13-32)
Avail: NTIS HC A12/MF A01 CSCL 03B

# 99 GENERAL

No abstracts in this category.

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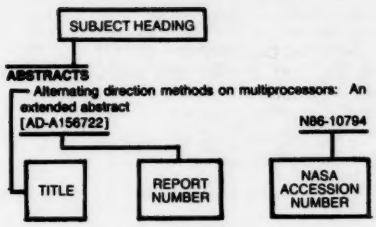


The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7053).

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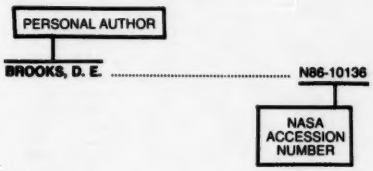


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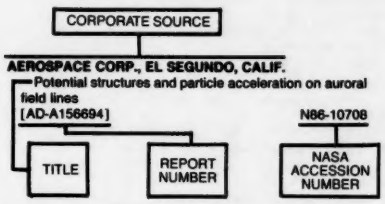


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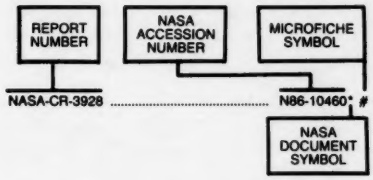


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